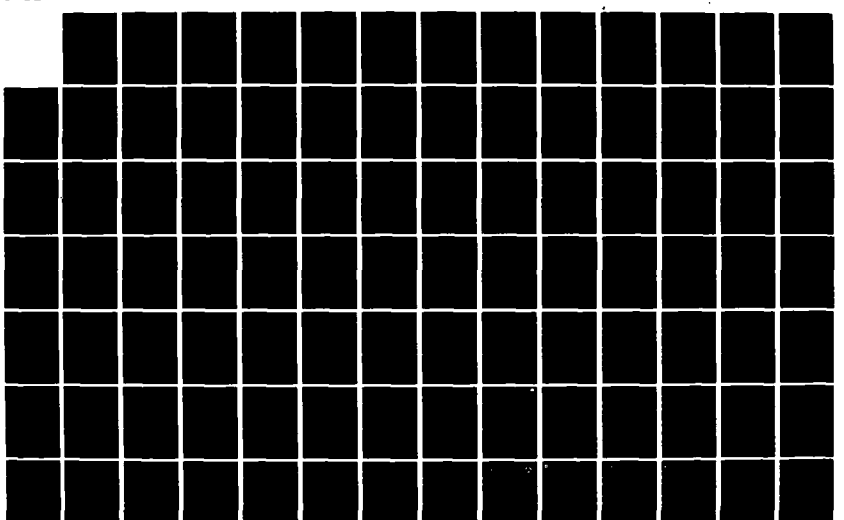
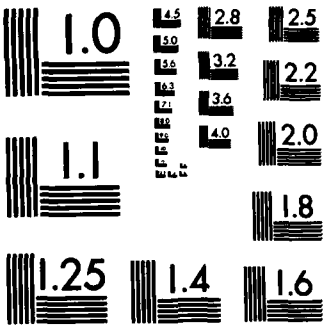
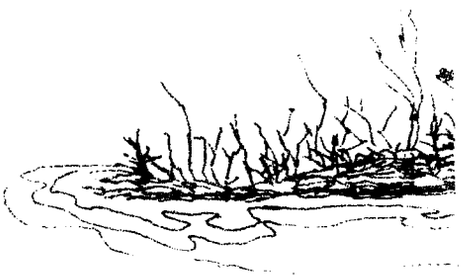
AD-A121 522 FINAL ENVIRONMENTAL IMPACT STATEMENT UPPER AND LOWER RED LAKES OPERATION A.. (U) CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT MAR 75 1/2

UNCLASSIFIED F/G 13/2 NL





FINAL ENVIRONMENTAL IMPACT STATEMENT
Upper and Lower Red Lakes



Operation and Maintenance Activities
Red Lake River Basin
Minnesota

March 1975

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. A121522	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) FINAL ENVIRONMENTAL IMPACT STATEMENT, OPERATION AND MAINTENANCE ACTIVITIES, RED LAKE AND CLEARWATER RIVERS PROJECT, MINNESOTA		5. TYPE OF REPORT & PERIOD COVERED Final EIS 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Paul 1135 U.S. Post Office and Custom House St. Paul, MN 55101		12. REPORT DATE March 1975 13. NUMBER OF PAGES 151
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Environmental impact statements
Red Lake River
Clearwater River
Upper Red Lake
Lower Red Lake

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The proposed action is the continued operation and maintenance of the Red Lake and Clearwater River Project by the U.S. Army Corps of Engineers. Presently operation of the reservoir permits continuous monitoring of water levels in the Red Lakes with the objective of reducing flood damages and augmenting streamflow during dry periods to help meet downstream requirements for water supply and marsh restoration. Water quality of the lakes appears to be good, and the flood control program has been beneficial with about 25,000 acres of cropland along the Red Lake River and 44,000 acres along the Clearwater receiving some degree of

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

potential flood damage reduction. Adverse effects on the economic and cultural environment of the Indians include loss of supplemental income due to loss of trapping and guiding as income sources, and the loss of food and hunting activity because of the loss of opportunity to hunt waterfowl and other game in the marsh area. These losses have occurred as a result of marshland drainage, which was partially caused by the channelization of the river.

FINAL
ENVIRONMENTAL IMPACT STATEMENT
OPERATION AND MAINTENANCE
ACTIVITIES
RED LAKE AND CLEARWATER RIVERS PROJECT
MINNESOTA

DEPARTMENT OF THE ARMY
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101
March 1975

FINAL
SUMMARY ENVIRONMENTAL STATEMENT
OPERATION AND MAINTENANCE
ACTIVITIES
RED LAKE AND CLEARWATER RIVERS
MINNESOTA

( ) Draft Environmental Statement (X) Final Environmental Statement

Responsible Office: U.S. Army Engineering District, St. Paul, Minnesota

1. Name of Action: (X) Administrative ( ) Legislative

2. Description of Action: The proposed action is the continued operation and maintenance of the Red Lake and Clearwater River Project by the U.S. Army Corps of Engineers. Project operation and maintenance activities are designed to assure the effective use of the flood control and low-flow augmentation system by implementation of the Red Lake Dam and the Red Lakes reservoir, and the modified channels along the Red Lake and Clearwater rivers. Attention has also been given to maintaining environmentally beneficial water levels in the marshes west of the dam through the Red Lake River Marsh Restoration Project.

3. a. Environmental Impacts: Present operation and maintenance of the reservoir permits continuous monitoring of water levels in the Red Lakes with the objective of reducing flood damages and augmenting streamflow during dry periods to help meet downstream requirements for water supply and marsh restoration. Water quality of the lakes appears to be good, and the flood control program has been beneficial with about 25,000 acres of cropland along the Red Lake River and 44,000 acres along the Clearwater receiving some degree of potential flood damage reduction. The project has also improved local drainage and promoted agricultural development. The cities of Crookston, East Grand Forks and Thief River Falls rely on the Red Lakes for water supply, as well as for power and industrial uses. The surrounding farmlands also use the water for livestock and irrigation. Changes in fish production have occurred but do not appear to be directly related to current operation and maintenance activities. Recreational activities may be affected by significant changes in water levels. Wild rice production has not been altered.

3. b. Adverse Environmental Impacts: Indian life is so closely tied to natural ecosystems that any adverse environmental effects of the project are directly transferred as adverse effects on the economic and cultural environment of the Indians. These adverse effetts are: loss of supplemental income due to the loss of trapping and guiding as income sources; and the loss of food and hunting activity because of the loss of opportunity to hunt waterfowl and other game in the marsh area. These losses have occurred as a result of marshland drainage. The drainage was caused, in part, by the channelization of the rivers.

4. Alternatives: The following alternatives to the Red Lake and Clearwater River Project or to features incorporated therein were considered:

a. No project operation and maintenance

b. Priority maintenance

c. Raise normal operating lake levels

d. Lower normal operating lake levels

e. Lower normal operating levels of marshes

5. Coordination: See pages 58 and 59 for a list of those furnished a copy of this environmental impact statement.

6. Draft Statement to CEQ: 13 January 1975

Final Statement to CEQ: _____

FINAL
ENVIRONMENTAL IMPACT STATEMENT
OPERATION AND MAINTENANCE
ACTIVITIES
RED LAKE AND CLEARWATER RIVERS PROJECT
MINNESOTA

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT.)

TABLE OF CONTENTS (CONT.)

TABLE OF CONTENTS (CONT.)

FINAL
ENVIRONMENTAL IMPACT STATEMENT
OPERATION AND MAINTENANCE
ACTIVITIES
RED LAKE AND CLEARWATER RIVERS PROJECT
MINNESOTA

INTRODUCTION

The purpose of this statement is to determine the environmental impacts of operation and maintenance activities necessary for the Red Lake and Clearwater Rivers Project. This statement has been based in part on an environmental assessment report prepared by North Star Research and Development Institute, under contract with the St. Paul District, Corps of Engineers.

1. PROJECT DESCRIPTION

Project Location

1.01 The Red Lake Dam is located at the outlet of Lower Red Lake in the northeastern part of Clearwater County, Minnesota, approximately 18 miles northwest of the village of Red Lake, Minnesota, and 188.4 river miles above the mouth of the Red Lake River (see exhibit 1, Technical appendix page A-1.) The Red Lake River Basin covers about 6,000 square miles over all of Red Lake County and parts of Koochiching, Beltrami, Clearwater, Marshall, Pennington, Polk, Mahnomen, and Itasca Counties.

Project Purposes

1.02 The improvements were intended to reduce flood damages and improve farm drainage along the Red Lake River; to augment streamflow during dry periods to help meet downstream requirements for water supply; and originally to reduce pollution from downstream urban areas by dilution of effluents. Further improvements were made to restore marshy conditions along the banks of the Red Lake River above the control structure at river mile 178.82. Project operation and maintenance activities are designed to assure the effective use of the flood control and low-flow augmentation system, however, due consideration is given to maintaining environmentally beneficial water levels in the marshes just west of the dam.

Project Authorization

1.03 The Red Lake and Clearwater River Project was authorized by the Flood Control Act of 12 December 1944 (P.L. 78-534) in accordance with the recommendation contained in House Document Number 345, 78th Congress, 1st Session.

Preproject Development

1.04 Residents of the Red Lake River Basin have been harrassed by floods of varying frequency and intensity since the agricultural development of the area began. According to historical and hydrological data, before the project, major flooding occurred during the years 1887, 1896, 1901, 1902, 1904, 1905, 1908, 1915, 1916, 1919, 1922, 1925, 1927, 1937, 1938, and 1941, while minor flooding has occurred in practically all the remaining years since 1896 with the exception of the drought years of 1934, 1935, and 1936. In accordance with an Act of Congress on 21 June 1906, which authorized a "drainage survey of certain wet, overflowed or marshy lands ceded by the Chippewa Indians to the State of Minnesota, with a view of determining the possibilities of their reclamation by drainage", the U.S. Geological Survey executed a survey in 1907-1908. A comprehensive drainage program for the basin was submitted in 1909. Large-scale construction of drainage ditches by judicial drainage districts and other local interests occurred during the years 1910-1916. In 1931, the United States Department of the Interior, Bureau of Indian Affairs, constructed a control structure at the outlet of Lower Red Lake to regulate the level of both Lower and Upper Red Lakes. However, certain areas along the Red Lake River were still subject to flooding. Water supply had also become a problem along the Red Lake River. At various times during the 1930's, the flow in the river had been inadequate. From 1934 through 1936 there were extended periods when flow in the Red Lake River ceased entirely. Efforts to obtain sufficient quantities of good quality water from wells were unsuccessful.

Project Development

1.05 The Flood Control Act of 1938 authorized the Corps of Engineers to make a preliminary examination and survey report of the Red Lake River and its tributaries. The report proposed a plan of improvement which included channel enlargement and straightening on both the Red Lake and Clearwater Rivers, modification of the existing control structure at the outlet of Lower Red Lake, and regulation of lake stages with normal pool elevation at 1174.0 (1912 adj). These improvements were detailed in the Definite Project Plan approved by the Chief of Engineers on 14 March 1947, which also called for raising 6.9 miles of Minnesota State Highway No. 1 at the west end of Lower Red Lake. Later the authorized channelization plans were modified, largely at the insistence of the General Council of the Red Lake Dam. Instead, channel control works were constructed at river mile 178.8, about 4 1/2 miles east of the west boundary of the Reservation, and no channelization was undertaken between that point and river mile 185.2. Construction of the amended project began in February 1948 and was completed in 1956.

1.06 The intent of these changes was to restore and preserve marshy conditions along the banks of the river in the Indian Reservation. However, additional measures were needed. A letter report, NCPGW, St. Paul District to North Central Division, 1 May 1957, subject: Effect of the Red Lake-Clearwater Flood Control Project on Fish and Wildlife Values in the Red Lake Indian Reservation Area, recommended detailed planning and

construction during Fiscal Year 1958 of needed improvements. The report called for replacement of the existing rock-and-brush weir at river mile 178.8 with an 80-foot long concrete overflow structure having a fixed crest at elevation 1166.0 and raising of both dike abutments to elevation 1171.0, closure of the spoil banks along both sides of the Red Lake River in the 3.2 mile stretch immediately below the Red Lake Dam, together with construction of low tie-back dikes at the lower end of the spoil banks. These features were constructed in 1958 in accordance with the recommended plan. Nevertheless, further measures were required to restore the marshlands bordering the 3.2 miles of river west of the dam. A 14 July 1965 General Design Memorandum called for diverting water from the Red Lakes by gravity directly to the low marsh areas north and south of the river by means of gated inlet culverts through State Highway 1. Other elements of the plan included a system of new dikes along the lower end of the marsh, controlled outlets to permit lowering pool levels for winter operation, and clearing and grading of existing continuous spoil banks along the river to provide suitable access to the outlet structures. These improvements were completed in 1967.

Structures

1.07 Dam: Red Lake Dam consists of an earth dike road along the western edge of Lower Red Lake with a top elevation of 1181.5. The top width of the dike is 32 feet with a 20-foot pavement width. The maximum height of the dam is 15.5 feet and length is 36,500 feet.

1.08 Outlet Structure: The control structure is located in the natural outlet of Lower Red Lake. It consists of a broad-crested weir at elevation 1169.6 surmounted by four 16-foot bays. The discharge through three bays is regulated by lift gates and through the fourth bay by two 8-foot stop-log sections. The abutments and intermediate piers of the outlet structure support the bridge which carries Minnesota State Trunk Highway Nos. 1 and 89 over the structure. Beginning at the downstream end of the abutments and extending through the stilling basin, vertical walls form the sides of the outlet structure. A curved drop section is located 39 feet downstream from the gates. The stilling basin is 12.0 feet long, 71.5 feet wide, and the floor is at elevation 1165.0. An end sill with top elevation at 1166.0 is provided at the downstream end of the stilling basin tie into the 113-foot channel which carries the flow downstream.

1.09 Reservoir: Upper and Lower Red Lakes are connected by a small strait known as the "Narrows". Together they cover an area of about 450 square miles. Most of the inflow into Red Lakes comes from the Tamarac River which enters Upper Red Lake from the east and the Battle and Cormorant Rivers which empty into Lower Red Lake. The capacity of the reservoir is sufficient to contain the maximum probable storm with an increase in water surface elevation of only 2.6 feet. Such an event, occurring when the lakes are at the maximum regulated level, would raise the lake level to 2.5 feet below the crown of the dam-roadway.

1.10 Marsh Inlets: Two inlet channels with slide-gate-controlled culverts beneath State Highway 1, one about 0.5 mile south of the Lower Red Lake outlet and the other about 0.8 mile north, divert water from the lake into the marshes. These inlets were originally designed to raise marsh levels from elevation 1172.5 to a maximum of 1174.0 in about 2 weeks, assuming normal spring lake levels. Presently, the north marsh drains eastward, through the intended inlet structure, into Red Lake. The situation is being investigated for possible solutions. The inlet structures consist of three 60-foot, 51 x 31-inch reinforced concrete pipe arches under State Highway 1, two at the south inlet and one at the north, with 54 by 36-inch sluice gates mounted in gate weirs on the west side of Highway 1. The outlet ends of the pipes have standard flared end sections and the concrete headwalls at the pipe inlets have bar screens for fish barriers. Lakeside approach channels have 30-foot bottom widths and 1 on 4 side slopes. Marsh inlet channels west of the highway have 100-foot bottoms and 1 on 3 sides; both are over 2,000 feet in length. Pipe outlets are riprapped for protection against scour.

1.11 Marsh Outlets: Two gate-controlled outlet culverts near the lowest ends of the marshes, one for the south marsh area and one for the north marsh, provide for control of marsh levels and were originally designed to lower pool levels for winter storage capacity from elevation 1174.0 to 1173.0 in about 2 weeks. The outlet structure for the south marsh consists of a 54-foot long, 42-inch corrugated-metal pipe beneath the spoil bank with a sluice gate mounted on a reinforced concrete headwall at the pipe inlet and a standard flared end section at the pipe outlet. The outlet structure for the north marsh includes a 39-foot, 30-inch corrugated-metal pipe beneath the spoil bank with a sluice gate inlet and standard flared outlet. Ditches with a 5-foot bottom width and 1 on 3 sides slopes lead from the marsh to the pipes and ditches with a 10-foot bottom width and 1 on 3 side slopes lead from pipe outlets to the Red Lake River. The ditches are riprapped near the pipe outlets.

1.12 Levees: Water in the restored marshes is confined by a system of spoil bank levees and low tie-back dikes on the western side of the marshes. The spoil banks and dikes have a designed top elevation of 1176.0 to provide a 2-foot freeboard above maximum marsh elevation of 1174.0. The total length of the spoil bank and tie-back dikes is 31,900 feet and 7,080 feet respectively. The spoil banks have 12-foot top widths to provide access to the marsh outlet structures. The marsh-side toe of the spoil banks is constructed of impervious clay to prevent seepage. The tie-bank dikes, constructed of impervious clay, also have 12-foot top widths, with 1 on 3 side slopes, and heights varying from 1 to 5 feet.

1.13 Control Works - (Weir): A concrete weir 80 feet in length, situated midstream between confining earth dike abutments, (exhibit 2) is the main feature of this structure. Under the north embankment is a gate-controlled culvert, designed to regulate flows during periods of low water in the river. The weir itself, having a crest elevation

at 1166.0, was designed to maintain marshy conditions upstream, while permitting satisfactory drainage downstream.

1.14 Channels: The original project plan called for channelization of the Red Lake River from river mile 150.63 to the lake. Because of objections from local residents at both ends of the project area, the plans were modified. The Red Lake River was deepened and widened between miles 154.3 and 178.5, and also in a 3.2 mile reach below the outlet structure. The river was also straightened, with numerous cut-offs, above mile 162.6 at the River Valley Bridge. Channel cross-sections are typically 74 feet wide from mile 154 to 166, 76 to 85 feet wide from mile 166 to 179, and 113 feet wide from mile 185 to 188, with side slopes excavated 1 on 1. Channel bottoms were deepened and flattened over all improvement reaches. The streamflow capacity of the improved channel varies from 1,000 cfs at the outlet to 1,520 cfs at the downstream end of the project with about 1 foot of freeboard. This corresponds to the 10-year frequency flow and maximum regulated reservoir discharge. The Clearwater River was also modified to accommodate 10-year frequency flows. The improvements included snagging and clearing between river mile 31.8 and 41.6, and widening, deepening and straightening between mile 41.6 and 79.1. Channel cross-sections are typically 49 feet wide 1 on 1 side slopes between 51 and 64, and 27 to 31 feet wide with side slopes 1 on 3 from mile 64-79. The streamflow capacity of the improved reach varies from 850 cfs at the upper end to 1,510 cfs at the lower end.

Operation Procedures

1.15 Reservoir: Present operating guidelines call for the lowering of the reservoir level beginning about 15 September, to reach a level of 1173.5 by 1 April. The drawdown starting date is based on a request by the U.S. Fish and Wildlife Service for stabilized water levels downstream from the dam, and on the water requirements for sugar beet processing which usually starts the latter part of September and lasts approximately 120 days. This drawdown provides additional storage capacity for spring runoff. Since the normal spring recharge is about 1.0 foot, the crest level of about elevation 1174.5 is expected annually. However, should abnormally heavy rains occur, the lake could rise to elevation 1176.43, the maximum regulated elevation. This rise may be affected by both runoff form heavy rains and the closing of the outlet gates during periods when lowering discharges from the reservoir, might prevent (or reduce) downstream flooding. Should the maximum probable storm occur, a further rise of 2.6 feet to elevation 1179.03 would result. Normal pool level from April to September is 1174.0. When lake levels get above 1174.0, the outlet gates are opened to allow the maximum discharge of 1,000 cfs, if downstream conditions permit. When lake levels get below 1174.0, discharge is limited to that amount needed to meet downstream requirements for water supply and pollution abatement. Exhibit 3 indicates the reservoir regulation schedule for Red Lake Dam. Operation of the outlet structure is performed by the Red Lake dam tender, on instructions from the Reservoir Regulating Section, Hydrology and Hydraulics Branch, St. Paul District Office, Corps of Engineers.

1.16 Marshes: The marshes are regulated by the Corps of Engineers in cooperation with the Bureau of Indian Affairs and the Fish and Wildlife Service. Project documents called for operation involving opening of the inlet culvert slide gates after spring breakup to divert water from the Lower Red Lake into the marshes, and controlling the flow into the marshes during the spring and summer seasons, as necessary, to maintain desired marsh levels for waterfowl nesting, mink and muskrat propagation, northern pike spawning, and wild rice production. The suggested method of operation includes the raising of marsh levels from elevation 1172.5 at the start of the filling period to the maximum permissible level of 1174.0. This can be achieved in about 2 weeks, assuming an average spring lake level of 1174.3 is reached by the end of the filling period (around 7 May). It was proposed that the marshes usually be filled by mid-May so that waterfowl nesting is not adversely affected; however, in autumn, water would be released from the marshes through the outlet culverts until marsh levels are lowered to elevation 1173.0 for winter. This would be done to improve waterfowl feeding areas along the margin of the marshes. If conditions prevent the marshes from filling to desired levels, the marshes would be kept as full as lake levels permit.

1.17 Operation of the marsh inlets and outlets is performed by a University of Minnesota Agricultural Extension Agent. The operator consults Tribal officers and the U.S. Fish and Wildlife Service for advice on marsh regulation. Contrary to project document suggestions, a high water level in the marshes is being maintained year-round in the belief that the suggested winter drawdown would adversely affect the habitat for fur-bearing animals, and that this disadvantage would outweigh any benefits to waterfowl. Marsh regulation is also hampered by the absence of water level gages. Fluctuating water levels would influence the marsh productivity through their influence on bottom soil nutrient release.

1.18 Project Maintenance: This includes regular monthly and yearly inspection by the dam operator and normal upkeep of the control structures, continuous spoil banks, dikes, and channels to assure effective functioning of the project. At certain times the Red Lake River becomes congested with underwater vegetation to the point where the flow is almost blocked. In order to continue to discharge from the dam to keep the lake at acceptable levels, it is necessary to remove some of this vegetation with underwater weed cutters. Routine maintenance such as structure upkeep, painting and greasing is performed by the Lake Winnibigoshish dam tender. Channel maintenance outside the Red Lake Indian Reservation is the responsibility of local interests. To date no channel work has been required. The collection of streamflow and hydrologic data is accomplished with the cooperation of the U.S. Geological Survey and the U. S. Weather Bureau. Exhibit 4 indicates actual expenditures on the project through 1975.

2. ENVIRONMENTAL SETTING

Condition of Project Land and Water Prior to Project Construction

2.01 Introduction: The Red Lakes area is a broad, level lake plain in northcentral Minnesota. Upper and Lower Red Lakes, having maximum depths of 20 and 35 feet respectively, and covering approximately 291,000 acres are the dominant features of the area. About 80 percent of the area is covered by forests and lakes, but land usage rangers form marshland to farmed prairie. Topography varies from the nearly level marshes in the northern part of the area to the morainal ridges rising 100 to 200 feet above the adjacent terrain in the south.

2.02 Climate: Within the Red River Basin the temperature variation is extreme, ranging from an all-time low of -50° F to a high of 109°F, The average annual temperatures range from 29.2°F to 49.5°F at Red Lake, Minnesota. The short growing season, from 5 June to 27 October, has limited agriculture to small grains and forage (Baker and Strub, 1965).

2.03 The average precipitation over the Red Lake River Basin varies from 20 inches per year on the western edge to 23 inches per year on the eastern border. The majority of the precipitation occurs during June, July, and August with an average of 10 inches falling during this period. The normal snowfall is about 40 to 50 inches per year. The majority of the precipitation in the region is lost through evapo-transpiration which averages 19.4 inches per year. The remaining average runoff of 2.6 inches per year occurs primarily in the form of spring snow melt.

2.04 Geology: About 80 percent of the Red Lake River Basin was formed as the bottom of the ancient glacial lake, Lake Agassiz. Sediments from the lake form the major underlying soil types. The topography varies from the relatively level plains in the north to the dune-like moraines in the south. The overlying soil throughout the region is primarily peat intermingled with poorly-drained mineral soils. The water table is high throughout the region with boggy areas and numerous small lakes being very prevalent.

2.05 Vegetation: The lakes are surrounded by three major natural vegetation types (See exhibit 5). The predominant type around Upper Red Lake is Conifer Bog, with tamarack (Larix laricina), black spruce (Picea mariana) and arbor vitae (Thuja occidentalis) as dominants. Near Ponemah and encircling Lower Red Lake except on the west is the Great Lakes Spruce-Fir Forest, dominated by balsam fir (Abies balsomea) and white spruce (Picea glauca). To the west, along the Red Lake River, Bluestem Prairie is the natural vegetation type where the land is not farmed, with dominants of big and little bluestem grass (Andropogon-gerardi and A. scoparius), switchgrass (Panicum virgatum), and Indian grass (Sorghastrum nutans). In general, the poorly drained areas support large stands of spruce and cedar, and pine and mixed hardwoods thrive on the drier sites.

2.06 Aestheitc Value: In the fall of 1920, the Red Lakes area was visited by the world-famous ecologist, the late Paul L. Errington. A few excerpts from his writings (Errington, 1973) describe the project area as he-a young man of 18-saw it while paddling his canoe up the Red Lake River. He reached the area just after witnessing the environmental damage brought about by recent drainage of areas surrounding Mud and Thief Lakes (eastern Marshall County):*

> "There on Minnesota road maps, occupying most of the north-central part of the state and extending up to the Canadian border, lay one of the biggest blank spaces in the United States.
>
> Tops of dark conifers protrude...from the hardwood forest... The stream borders become marshy...growths of wild rice... muskrats and ducks, muddy game trails between water and woods...
>
> Hardwood forest...not merely river-bottom woodland such as I had known along the Big Sioux River back in South Dakota, this was the beginning of genuine forest.
>
> On the Reservation itself, the Red Lake River drained what was then—so far as I could see from the canoe--real wilderness...There were heavy growths of wild rice lining the open channel of the river which meandered through a wide marsh downstream from the outlet of Lower Red Lake.
>
> I remember at one place a peculiar tinkle, which came from a pool so full of minnows that they looked almost solid in the rays of a flashlight. When pike drove through the massed minnows, the minnows popped into the air to fall back into the water with the tinkling sound.
>
> Between my hilltop camp and the lake beach lay a narrow strip of white cedar swamp. The outermost cedars extended out on the sand ridge of the beach to within ten to fifteen feet of the water's edge; and there were no cut stumps, no ax or saw marks, no cans, bottles, cigarette packages, no junk either along shore or in the strip of cedar swamp. Neither were there 'deer lines', where deer had overbrowsed the lower cedar growths, though a lakeside trail had tracks of deer as well as wolves.

---

* By permission from The Red Gods Call, Iowa State University Press.

The lakeside fringe of cedars was so solid that I had to push through it to enter...impression of unlimited age, of primeval life...trunks of the living cedars were two feet or more in thickness...mosses and lichens covered everything...on the ground, punky down-logs lay partly sunken into the swamp floor.

How very tame they (the ducks) were...They would often come straight for me, or veer off slightly, or hover... This hunting must have been like that done by the old-time market hunters with their black powder loads. The whole duck population behaved as if they did not know what firearms were.

In opposite directions along the sand ridge (at the outlet of Lower Red Lake), the wooded lake shores stretched away and disappeared into only water and sky...I had the thoughts of being alone on a beach between a marsh and a sea in an otherwise manless world...the scene could have gone back a million years."

2.07 Errington listed much of the vegetation and wildlife he observed at that time. This information is included in exhibit 6. Seven or eight years prior to his visit there had been a population explosion of snowshoe hares; this was followed by a collapse in that population. In their original state, these marshes provided a continual and abundant habitat for waterfowl and fur-bearing animals, and in the weed-choked ditches near them, large northern pike were caught in the 1920's.

2.08 Early Marsh Drainage: Drainage of the extensive marshes in northern Minnesota by farm interests had its beginning from 1910 to 1916 by judicial drainage districts and other local interests. The "off-take" ditch (see exhibit 7, page A-9) that drains large portions of the marshes in the western part of the Reservation north of the Red Lake River, however, was probably dug around 1925 to 1928, according to Reservation residents, and other such ditches were presumably put in around the same time. Extensive ditching had already occurred by 1930. Thousands of acres of marshland had been affected, but much of it was still unfit for farming. At that time, the Red Lake River had inadequate capacity to carry discharge from the drainage ditches. Some marshes adjacent to the Red Lake River were unditched or unaffected. In the late 1940's these marshes were still judged to be in fine condition.

2.09 Early Floodplain Agriculture: Despite extensive ditching, large areas along the Red Lake River remained too wet to farm, particularly in the flood-prone area affected by the Red Lake River Project. This area comprises most of the eastern third of Pennington County, Minnesota. Before the project, almost half the floodplain land privately owned was uncultivated. Additionally, some lands were in public ownership, unsettled or tax forfeited. These lands were largely peat bog and were not expected

to be cropped even after a flood control program. The main cash grain crops in the area were, in descending order, flax, oats, and barley; sweet cloves and alfalfa seed were the principal crop specialties. Small herds of dairy cattle were also raised, feeding on the abundant roughage in the area. Precise land use figures for the Red Lake River floodplain above Kratka (the area affected by the project) were not available. However, a 1939 Corps survey of the entire Red Lake River basin offered the following figures for all floodplain areas in Pennington County:

Land Use	Acres	Pct.
All floodplain total	152,476.0	100.0
Non-farm	22,089.5	14.5
Farmland	130,386.5	85.5
Non-crop, brush, waste, etc.	54,455.9	35.7
Cropland	75,930.6	49.8
Non-depleting	41,221.0	27.0
Depleting	34,708.7	22.8

2.10 Except during the drought years 1934 through 1936, frequent flooding and poor drainage plagues this area. In an attempt to assess the primary benefits of the proposed flood control project, the Corps reported the calculations shown in exhibit 8. These graphs demonstrate the impact of frequent flooding on the area in its preproject state of development. Curves showing the expected flood damages after the project probably do not take into account any land use changes which may occur due to improved farming conditions brought about by the project.

2.11 Limnology: The Red Lakes are a conspicuous feature of the environmental setting of northwestern Minnesota. The combined surface area of Upper and Lower Red Lakes at the 1174 foot elevation is about 290,800 acres. The lakes are shallow with the maximum depth in the Upper Red Lake at 20 feet, and Lower Red Lake at 35 feet. The mean depth of the Upper Red Lake is 3.5 feet and Lower Red Lake is 18 feet. In both lakes the 6-foot depth contour is located at least 600 feet off the beach on most shorelines. In the lakes the water depth increases gradually with a steep dropoff occurring between the 8 and 15-foot contours. There are no bays on either lake and thus all shorelines are exposed to heavy wave action. The surfaces of the lakes are continually subject to strong wind currents. The beach areas on both lakes are mostly sandy with the exception of gravel areas along Ponemah Point and on the south shore near Redby. The lake bottom soil is sandy from the shore to a depth of 17 to 20 feet where it grades into an organic muck.

2.12 The limnological conditions in both lakes are governed by the large surface areas and shallow water depths which promote extensive mixing and continual circulation of the lake waters. The water temperature stratum tends to follow changes in air temperatures. The lakes do not stratify except for very short periods. Peterka and Smith (1970) reported that the water temperatures in mid-lake areas of Lower Red Lake range from 62° to 72°F. Because the lakes are thoroughly mixed most of the time, the dissolved oxygen concentration is usually within 1 percent of saturation at any given water temperature. The alkalinity of these lakes ranges between 130 and 160 ppm.

2.13 Because of the large surface areas and very shallow mean depths, the littoral zones of the two lakes are extensive. Aquatic vascular plants abound in the shallow waters of the north, south, and west shores where bands of the bulrush, Scirpus sp., are found 50 to 100 feet off the sand beaches. On the periphery and occasionally mingled with the Scirpus sp. there are scattered beds of the ponweed Potamogeton. Aquatic vegetation is absent in the shallow water and sandy soil areas on the east shore. All of these limnological features produce a potentially productive littoral zone which is conducive to the spawning and growth of fish.

2.14 Water Quality: Surface Water Runoff into the Reservoir: The stream that enter the reservoir originate on low flat land that has little topographic relief. Streams entering the north and east portion of the lake originate in bog terrain, while the southern portion of the Red Lakes watershed drains peat soils intermingled with mineral soils.

2.15 The largest stream entering Upper Red Lake is the Tamarack River which drains approximately 200 square miles with a yearly average discharge of 80 to 90 cfs. The only other stream of noticeable discharge is Shotley Brook which enters on the southeastern shore. The latter drains 75 square miles. There is no data for yearly stream discharge, but it is probably a quarter to a half that of the Tamarack River. The Hydrologic Investigation Atlas estimates the minimum discharge to be greater than 0.5 cfs per 7-day period with a 2-year recurrence frequency. (Bidwell, et al., 1970).

2.16 Almost all of the surface water entering Lower Red Lake enters on the south and east shores of the lake. The major flow is from the Cormorant River entering on the southeastern shore. The watershed for the river includes areas drained by the North and South Branches of the Cormorant River plus the Blackduck River. The combined watershed is approximately 260 square miles and the annual average discharge is 90 to 100 cfs. Four smaller streams, the South Branch of the Battle River, Mud River, Pike Creek, and Sandy River, drain approximately 200 square miles and discharge about 70 cfs annually.

Condition of Project Land and Water During the Project: 1951 to 1971

2.17 Changing Conditions: After the construction of the flood control structure, problems began to appear. First, drainage of the large marsh area adjacent to the outlet structure occurred. This had the reported effect of reducing the populations of animals such as muskrat, which had supported a profitable trapping enterprise, and deer, which had been hunted.

2.18 Within the last decade, the commercial growing of wild rice, Zizania aquatica, has become popular and of great economic importance in northern Minnesota, especially in the low land areas which surround the Red Lakes. To this end, questions have been raised concerning the operation of the outlet structure on impounding waters containing nutrients which may issue from the rice paddies.

2.19 Recently, apparent reductions have occurred in the size of the catch of the commercial fishery which is operated by the Red Lake Band of Chippewa Indians on both Red Lakes. Questions have arisen concerning the possible connection between construction and operation of the flood control structure and the production of commercially fished species in Lower Red Lake.

2.20 Decreases in Muskrats and Waterfowl in Zah Gheeng Marsh: In 1955 representatives of the Duluth sportsmen's organization reported that duck hunting and muskrat trapping had been adversely affected by gradually decreasing water levels in marshes adjacent to the Red Lake River. This information, coupled with the statement that Indian income from guide fees and hunting permit sales was jeopardized, was relayed to Representative John A Blatnik and to the Corps of Engineers. On 28 May 1956, a meeting of representatives from the Bureau of Indian Affairs, the Minnesota Department of Conservation, the Duluth sportsmen's organization, and the Corps of Engineers was held in Bemidiji and, later, there was an on-site inspection conducted by boat. At this time, elevation at the tailwater gage near the lake outlet was 1168.9 and channel flow was 150 cubic feet per second; adjacent marshes were reported to be "generally dry", no muskrats were seen and ducks were "scarce".

2.21 A letter written 6 June 1956, by representatives of the Bureau of Indian Affairs reported that an 80 percent decrease in trapping (exhibit 11) had occurred in marshes adjacent to the project and that the Indians desired an investigation of the flood control project's effect upon Reservation wildlife. On 3 July 1956, the Bureau of Indian Affairs and the Corps of Engineers representatives agreed that the United States Fish and Wildlife Service should be asked tc prepare a report.

2.22 Studies made by the United States Fish and Wildlife Service prior to their 1957 report (USDI, 1957) revealed that the marsh was indeed in serious condition and was no longer able to support large numbers of waterfowl and furbearers. The recommendation was made that "in the interest of the Red Lake Band of Chippewa Indians, every effort should be made to effect restoration of this great marsh to its former condition."

2.23 The United States Fish and Wildlife Service (USDI, 1957) reported annual losses of $29,500 in revenues from hunting and trapping on the Reservation, but review of the figures by Corps of Engineers personnel suggested that a closer approximation of annual losses would be $16,800. The discrepancy between the two calculated figures was based mainly on the Corps of Engineers contentions that hunters spend little money aside from hunting and guiding fees on the Reservation; that calculations of reductions in fur harvests should be based on annual average figures determined by averaging the catch over a 4-year period, and that approximately 80 percent of the trapping was done on the affected marshland.

2.24 In addition to the loss of revenue to the Indians as a result of declining guide and license fees and fur harvests, an additional burden was imposed by the constant threat of fires in the dried marshes. Fire in a dry peat bog is a serious affair, and a fire thought to be under control may smolder for many months or perhaps for several years before flaring up anew. In 1956, a single fire was said to have burned a minimum of 50,000 acres in the Red Lake Reservation and many of the small lakes and potholes in the old marshes are the result of "burn-outs" of peat.

2.25 Proposal for Restoring Marshes: The United States Fish and Wildlife Service report suggested that diversion canals be put through the highway (along the west side of the lake) and equipped with control structures which might be used to increase water flow into the marshes and recommended that engineering feasibility studies be made. Openings in the spoil banks for a distance of 3.2 miles downstream from the dam would be closed to prevent drainage from the confined marshes into the river. A further restoration along a 4.5-mile segment of the channel located downstream from the other area was also recommended. The Corps of Engineers response to the United States Fish and Wildlife Service report was highly favorable; the opinion expressed in the May 1957 Corps of Engineers Report stated: "At this time there can be little doubt that the suggested improvements would restore marsh conditions in the area. In fact, it appears that, if followed in their entirety, they probably would materially better wildlife conditions over those which prevailed prior to construction of the Red Lake Project" (U.S. Department of the Army, 1957b, p. 7). The Corps of Engineers also conceded that the rock and brush weir at mile 178.8, had, in spite of repairs, settled at a lower level than that planned, and was allowing excessive drainage of adjacent marshes.

2.26 Early Efforts at Marsh Restoration by the Corps of Engineers: Specific improvements were designed by the Corps of Engineers in 1957, (see exhibit 12, page A-14) including the construction of an 80-foot concrete overflow structure with a fixed crest of 1166 feet to replace the rock and brush weir, raising the dike abutments to 1171.0 feet, closing the spoil banks where necessary, and construction of levees at

the lower end of the spoil bank dikes. Costs, estimated at $83,000, would be borne by the United States Government. The Corps of Engineers noted that the Indian Service (Bureau of Indian Affairs) anticipated some decline in wildlife values "when it requested that the channel improvement be continued into the Reservation about 4.5 miles eastward of the west boundary" as part of a plan to drain land for project agricultural use by the Indians to provide " a more stable economy".

2.27 In 1958 the rock and brush weir at mile 178.8 was replaced by an 80-foot concrete overflow structure with a fixed crest at elevation 1166 and dike abutments at 1171. The old weir had failed to raise the water level in the river sufficiently to effect marsh restoration. That same year an attempt was made to seal 3.2 miles of the spoil banks along the channelized part of the river near the outlet, and low tie-back dikes were constructed at the west end of the spoil banks in order to prevent drainage of the marshes near the outlet.

2.28 Aerial photographs taken in 1959 show the Red Lake River after the channelization and after the replacement of the rock and brush weir at mile 178.8 on the Red Lake River, and before the restoration of the Zah Gheeng Marsh. The old meanderings of the river show clearly; some contain water. The general appearance of the marshes is very dry, and large stands of both coniferous and deciduous trees are visible. Small lakes, some the result of burn-outs in the peat bogs, are scattered about the bogs adjacent to the river.

2.29 Vegetation and Wildlife Studies by the Bureau of Sport Fisheries and Wildlife at a Nearby Marsh: 1964 to 1968: In 1965 the Bureau of Sport Fisheries and Wildlife completed a project to restore 7,000 acres of marshes on the north side of the Clearwater River in the Red Lake Reservation which had also been drained as a result of the Red Lake Project completed in 1952. Now entitles Ki-Wo-Say, the approximation for the Objibwa term for "hunting", the area was designed to serve as a wildlife refuge and to produce wild rice. Because no detailed ecological studies are available at the present time on the Corps Zah Gheeng Marsh Restoration Project, information from the Ki-Wo-Say study is presented here.

2.30 The vegetation in the marsh area north of the Clearwater River was studied by Northern Prairie Research Center (Bureau of Sport Fisheries and Wildlife) personnel Robert E. Stewart and Leo M. Kirsch in September, 1964, and by the same two men and Lewis M. Cowardin in August, 1965. They obtained data regarding relative coverage and relative frequency of plants based on the line-plot sampling technique. Fifty-two quadrats, each 2.25 square meters in size, located at 100-yard intervals along a transect 5200 yards long were sampled. The waterfowl development area was described as a "calcareous type of floating bog or quagmire." Vegetation along the transect was "fairly uniform" and was generally representative of an alkaline bog ecosystem. Northern reedgrass, aquatic moss (Drepanocladus, not Sphagnum) and sedges comprised the bulk of the

vegetation. Several yellow rails, a relatively rare bird, were flushed along the transect and 12 to 15 sandhill cranes were reported to nest nearby. Exhibit 13 presents the results of 1964 vegetation sampling.

2.31 Further studies conducted in 1965 included, in addition to the lineplot transect approach (using the same transect as in 1964), some information regarding seven potholes which had been blasted with ammonium nitrate. Specific conductance of pothole water was measured and water samples were taken for future analysis. Stewart, Kirsch, and Cowardin observed that the marsh was much drier than it had been in 1964. No standing water was seen and walking was easy, although the bog mat still "quaked" underfoot. It was suggested that drainage of water into borrow pits along new dikes was responsible for the drying of the bog. Observations of the vegetation near five of the potholes visited are recorded in exhibit 12.

2.32 There were no significant differences in the plant community along the transect, and some of the slight differences that did exist may be accounted for by the fact that the 1964 study was done in September and the one in 1965 was conducted in August. In addition to the plants identified in the transect quadrats, listed in exhibit 13, cotton-grass (Eriophorum sp), twig-rush (Cladium mariscoedes), and pitcher-plants (Sarracenia purpurea) were observed in the bog. Several pictures accompany the report. It was recommended that the vegetation survey be continued for 5 more years especially in view of the expected continued rise in water level in the marshes associated with the Ki-Wo-Say Project.

2.33 Attempts to make aerial waterfowl counts were frustrated by strong winds and the time of day on 25 May 1964 and 24 May 1965. Blue-winged teal (six or seven pairs and a few males), mallards (three of four pairs), and ring-necked ducks (one pair) were seen.

2.34 By August 1966 water levels had attained the full pool stage and a continual outflow was observed at the outlet. Stewart and Kirsch (1966) used a boat in studying the transect, but parts of the transect could not be studied because of dense mats of partially submerged vegetation. Sampling techniques were adapted to the changing ecosystem. Much of the transect was covered by open water with some floating masses of dead vegetation, and in some places isolated clumps of reeds (Phragmites) and willows were seen. Emergent bog meadow species such as northern reed-grass and watersedge were present in part of the transect, and in some places there were almost solid stands of such species. Common bladderwort, a typical submerged aquatic species, was reported from all quadrats and was the most important pioneering species in response to the flooding. Star duckweed and common duckweed were found in the shallower parts of the transect.

2.35 Ducks seen during the 1966 study included blue-winged teal, gadwall, pintail, mallard, and wood duck. Several sandhill cranes were also observed. Erosion of the shores of artificial islands constructed for duck hunting appeared to be severe at this time and it was suggested that water levels 6 to 12 inches lower might be better in these marshes (Stewart and Kirsch, 1966).

2.36 Water levels were stated to be considerably lower during a September 1967 study of the transect conducted by Cowardin, Stewart, and Nelson. The gage reading was 1175.4 at that time and a great change had occurred within the year in that large portions of previously submerged bog mat had broken loose and the resultant "sea of floating islands of mud and partially rotted vegetation" made travel both difficult and dangerous. Only ten of the quadrats could be examined, and it was impossible to obtain accurate measurements, though some of the old transect marking flags were seen. Three quadrats fell on massive segments of rotten bog mat and seven in open water.

2.37 It was the authors' opinion that roots of woody vegetation may have anchored the bog mat to the substrate and that, as a result of decay and wave and ice action, the roots broke and freed the mats. Most parts of the floating mat were only 6 to 8 inches thick and could not support a person.

2.38 Plants recorded in 1967 were: common duckweed, star duckweed, smaller bur marigold, spikerush, cattail, water horehound, small pondweed, and celery-leaved crowfoot. Also present but less abundant were willow herb, mare's-tail, hemlock water-parsnip, bulb-bearing water-hemlock, golden dock, hooded willow-herb, marsh watercress, swamp thistle, small bedstraw, and buckbean. No new duck species were seen, and waterfowl were scarce. Erosion was noted in a number of places.

2.39 Because of the difficulties involved in traveling along the transect, it was recommended that the transect be abandoned and that annual aerial surveillance be maintained instead. The effect of the floating bog mats on waterfowl production was uncertain. Methods of removal of floating mat were discussed, but the problems of floating bog mats were acknowledged to be troublesome. Some of the duck blinds that had been built on certain islands were unusable because of dense masses of mat around the islands. Pictures accompanying this report testified to the appearance of floating bog mat in 1967 as well as erosion around the outlet structure.

2.40 Zah Gheeng Marsh Restoration Project: An inspection of the headwaters of the Red Lake River and the adjacent marsh areas by the Corps of Engineers and other personnel on 21 May 1963, revealed that the marsh along the channelized portion of the river was dry except in the old oxbows of the original river channel (U.S. Department of the Army, 1965). Along the portion of the river remaining in its natural channel from the control structure at mile 178.8 to mile 185.0 the marsh was stated to be in excellent condition, with "hundreds of ducks and many muskrat houses".

It was concluded that the rebuilt control structure at mile 178.8 was functioning well in restoring some of the marshes along the natural (unchannelized part of the river, but that it had no effect on the marsh closer to the outlet of the lake. Spoil bank closures and tie-back dikes along the 3.2. miles of the channelized portion had not had any significant effect upon marsh restoration.

2.41 Other studies undertaken by the Corps of Engineers during 1963 included instrument field surveys for topographic mapping of marshes, soil borings in areas of proposed improvements, and hydraulic, hydrologic, design and economic studies.

2.42 The Corps of Engineers subsequently undertook construction of structures designed to reflood and restore the dried up marshes near the outlet of Lower Red Lake. The project, to be known as Zah Gheeng, is described in a Corps of Engineers report contained in the Office, Chief of Engineers, 4th Endorsement, ENGCW-OM, 18 March 1969, to letter NCSED-8, 29 January 1964. The improvements were completed in 1967. Cost of the project was $173,000 and included the following items:

1. Earth dikes (uncompacted impervious fill):
   7080 feet, 5 feet high, 2 feet freeboard above maximum pool, 12 feet wide, side slopes 1 on 3.

2. Clear and grade existing spoil banks:
   31,900 feet long, 12 feet wide, 1176 minimum top elevation.

3. Channels:

   Inlet approaches, east of State Highway 1:
   30 feet bottom width, side slopes 1 on 4.

   Inlet channels west of Highway 1: 100 feet bottom width, side slopes 1 on 3.

4. Inlet Structures:
   South marsh (0.5 mile south of river outlet):
   two 51 by 31-inch reinforced concrete arch pipe, 60 feet long with concrete headwall at inlet, flared end sections at outlet and two 54 by 36-inch slide gates.

   North marsh (0.8 mile north of river outlet): one pipe and one slide gate as mentioned above.

5. Outlet structures:
   South marsh: one 42-inch corrugated metal pipe, 54 feet long, with slide gate and concrete headwall at inlet and flared end section at outlet.

   North marsh: one 30-inch corrugated metal pipe, 39 feet long, with slide gate and concrete headwall at inlet and flared end section at outlet.

2.43 The most important aspect of the project was the potential recovery of wildlife and waterfowl populations in Zah Gheeng. In the first few years after reflooding, these populations did appear to be increasing. Prospects for continued increases were considered very good, since the new control structures made it possible to maintain consistently high water levels in the marshes.

2.44 Water Levels in the Lakes: The operation of the Red Lake Reservoir is somewhat unique. The installation of the 1931 structure (for the United States Department of the Interior) was designed only to regulate the water level of the lakes. Between 1931 and 1948, downstream residents of the Red Lake River Basin were inconvenienced periodically by both floods and low water flows. In 1944 approval was given to the Army Corps of Engineers plan to improve the control structure at the outlet of the Lower Red Lake to control the discharge from the Lakes while maintaining a water level near elevation 1174.0, when possible. Operation above 1174.5 would occur only when flooding increased in the Lower River basin or heavy rains caused a natural increase in the lake level. Levels below 1173.5 would occur only when minimum flow needs were required in the river for water supply and pollution abatement.

2.45 The Minnesota Geological Survey (Allison, 1932) lists the lake level at an elevation of 1175 feet. Corps references appear to indicate a lake level of close to 1174. The normal operation of 1174 feet was established in 1931 by the initial control structure. Since 1951 this has also been the goal of current operation by the U.S. Army Corps of Engineers. Normal operation of the reservoir at 1174 feet confines the lake to its natural banks, as does the winter drawdown (by April) to 1173.5 feet and normal raise to 1174.5 during the summer. Corps records since 1951 show that the lake has been operated with this goal in mind. The lowest recorded level was 1173.3 during 1952, 1954, 1964, and 1967. The highest level recorded was 1176.2 feet during 1962. High water fluctuations have been more common than low level fluctuations.

2.46 Water Quality: Although there has apparently been little information gathered during this period, some water quality data, taken in 1932, 1962, and 1972 on Lower Red Lake may be found in exhibit 14, page A-20).

2.47 Red Lake Fishery: (See exhibits 15-20, pages A-21 to A-26). During the period from 1930 to the present, when reliable records of production of fish have been kept, the catch statistics have shown marked fluctuations. For example, peaks in fish production have occurred in 1932, 1937, 1940, 1944, 1948, 1952, 1957, 1961, and 1967. To eliminate the effect of intensity of fishing on estimates of abundance, the catch per unit effort (CPE) is a good index and has been used by such authors as Peterka and Smith (1970) and Heyerdahl and Smith (1971). The principal species in the fishery is the walleye and fluctuations in this species (exhibit 16) exert a considerable influence on the fish production in the lakes. These fluctuations have been observed both in the period prior to the construction of the outlet structure and in the period after its completion.

2.48 The production data suggest that there is a fairly close relationship between the production of walleye and yellow perch. Apparently these two species are either interdependent or respond in a similar manner to factors in the environment which influence them (Smith and Krefting 1953). Peterka and Smith (1970) also report that the total catch of whitefish is strongly influenced by the abundance of walleyes. In a like manner, Smith and Pycha (1961) reported that the strength of year classes of walleye was positively related to the strength of whitefish year classes, although these authors did not attempt to develop any causative factors.

2.49 In the Red Lakes the northern pike and yellow perch are the most important competitors with the walleye. Although the northern pike acts as a predator on both species, fluctuations of the northern pike appear to bear no consistent relationship to changes in population levels of the other two species.

2.50 Smith and Pycha (1961) found that the annual production of walleye, which comprises an important component of the catch of the Red Lake Fisheries Association, is heavily dependent on a few year classes, particularly the V and VI age group fish. They also reported that variations in growth of walleye appeared to be greater in the female than in the male. Also important in influencing the production of walleye is that a smaller proportion of fish about to enter the commercial catch do so in years of poor growth because the fishing season is short and coincides with the season of growth.

2.51 The changes in fish production and population ratios that have taken place in the Red Lakes do not appear to be related to any changes in water quality produced by the outlet structure, if indeed these changes have occurred. Data on precise past water level fluctuations are not readily available. Similarly, it is difficult to relate the changes in the production of fish with the construction of the low head dam at the outlet, because production in the fishery has fluctuated in the years before and after its construction. Thus, if water quality had changed (i.e., improved or deteriorated after installation of the flood control structure by the Corps of Engineers in 1951) one would have expected either a consistent increase or a decline in fish production after that date. This suggests that the changes in fish production, or of the CPE, are the result of the response of fish populations in the Red Lakes to the factors which influence year class strength. And, that when changes in year class strength of the walleye are pronounced, especially in age groups V and VI, these weak classes will produce fewer catches. Smith and Krefting similarly suggest that the fluctuations may be the result of changes in the size of accumulated stocks of fish which are available to the fishermen or that they may result from differences in the strength of the year's class.

2.52 Several authors including Smith and Krefting (1953) and Smith and Pycha (1961) have shown that changes in walleye abundance are independent of gear competition or the extent of fishing activity in the commercial fishery. Instead, these authors report that walleye abundance is determined by the strength of individual year classes. Smith and Krefting state that year class strength of Red Lake walleye is not correlated with the size of the brood stock, the abundance of competing species, or the amount of hatchery fish planted. They also reported that weather conditions (total precipitation, mean temperature, and mean minimum temperature for the 30-day period following spawning) cannot be correlated with observed changes in strength of year classes and concluded that changes in abundance were caused by complex ecological changes not explained.

2.53 Careful examination of the literature provides information which helps to partially explain the causes of the extreme fluctuations that have occurred in the walleye abundance (CPE) during the period of 1930 to 1960. Accounts by Smith and Pycha indicate that during the early 1930's the growing seasons were quite long and the total degree-days were greater. Following the peak year of 1932 drought conditions prevailed and water levels in the lakes were lower. This paralleled a pronounced drop in CPE with a low occurring in 1936. Because of the presence of small walleyes in that year, there was a change from the 3-3/4 inch mesh nets that had been used previously to 3-1/2 inch mesh nets. In the early 1930's regulations were established to permit the use of 3-3/4 inch mesh nets up to a maximum of 1500 feet of net per fisherman. The CPE then increased to a peak in 1938. In 1941 the fishermen were permitted to use eight nets and a maximum of 2400 feet of net per fisherman. During the years of World War II the annual quota of 650,000 pounds was ignored because of the wartime requirements for fish protein. After the war the pre-war annual quota was raised to one million pounds. Also, during the late 1940's the growing seasons were shorter and the number of degree-days was less. In 1950 the 650,000 pound quota was reinstated at a time when the CPE was at its second lowest point since 1930. Smith and Krefting suggest that high water conditions in 1950 may have made fish less available to the fishermen. The low CPE of 1950 may also be explained by the presence of a weak year class in 1944 and an extremely weak year class in 1945. Simultaneously, in 1950 the populations of yellow perch were higher than in previous years and the goldeye (a forage fish used by walleye) declined in abundance (Smith and Pycha, 1961). The high CPE values for walleye in 1952 and 1953 were the result of above average strength year classes which were produced in 1946 and 1947 (Smith and Krefting, 1953). The year 1953 was also a poor growth year and marked the beginning of a slight downward trend which reached its lowest point in 1956. The low CPE in 1956 may also have been the result of a decrease in efficiency of the fishing gear which was related to a deterioration of the cotton webbing of the nets which was noticed by the middle of July of that year (Smith and Pycha, 1961).

2.54 The fluctuations that have occurred in the walleye fishery appear to be the result of many complex ecological and biological factors which operate in the lake. Of these factors, the year class strength appears to be of particular importance in producing sustained commercial production and that the general level of abundance will be strongly influenced by the strength of individual year classes. Although information on the strength of year classes during the years 1960 to 1972 was unavailable, examination of such data would be of great value in evaluating the peaks in abundance which occurred in 1961 and 1967. Likewise, these data would be helpful in predicting whether a resurgence of walleye production will take place in the near future, or whether the downward trend will continue in 1973. Extensive data on the production of fish in pounds (from Current Limnological Studies, 1972) dating back to 1930 are reported in the literature for the important species of the Red Lake commercial fisheries (exhibit 15, page A-21). These reports suggest that walleye, yellow perch, lake whitefish, northern pike, sheepshead, and goldeye have been the important species of the commercial catch.

2.55 The gross sales of the harvest of all species which comprise the commercial catch have increased from the 1930's to a high value of $529,623.32 in 1970 (exhibit 15). Comparison of the gross sales figures and the fish production of commercially fished species shows the historical trend in and influence of the price of fish.

2.56 Because, as Peterka and Smith (1970) suggest, the fishing effort has varied widely from year to year, a better estimate of the relative abundance of fish may be obtained based on the catch per standard unit of effort (CPE) which consists of one overnight summer season set of five 300-foot gill nets of 3-1/2 inch (stretch measure) mesh. There is good evidence that the 3-1/2 inch mesh nets have been in general use in the fishery from as early as 1919 (Van Oosten and Deason, 1957 and Smith and Krefting, 1953). The data for a standard unit of effort (CPE) are shown in exhibits 17, 18, and 19. These CPE data for walleye (exhibit 17) indicate that the catch of this species has fluctuated markedly from 1930 to 1972. It has been suggested that this species undergoes a cycle of abundance of approximately 7 years duration (Smith and Krefting, 1953). The CPE data for yellow perch (exhibit 18) suggest similar fluctuations in abundance. With the exception of the period of 1958 to 1963, yellow perch appear to occur in large numbers at the same time as the peaks in walleye harvest. The catches of the less important commercial species do now show this close apparent relationship (exhibit 19).

Present Conditions of Project Land and Water

2.57 Marsh Ecosystem: At the present time the restored Zah Gheeng Marsh seems to be functioning well and waterfowl and fur-bearer populations appear to be increasing on both it and the Ki-Wo-Say Marsh. A list of mammals known to be present is given in exhibit 21, page A-27. The wild rice paddies in the Ki-Wo-Say Marsh are reported to be especially rich in wildlife: a wide variety of waterfowl is seen here including mallards, baldplates, teal, ring-necked ducks, and scaup. The muskrat population in both marshes was estimated to be between 5000 to 6000 in the fall of 1972.

2.58 A winter drive through the portion of the Reservation near the Red Lake River reveals a relatively flat, almost treeless marshland with few human habitations except near the lake outlet. Water tumbles forcefully over the outlet dam and the concrete weir, the ice nearby is frozen into grotesque shapes. Muskrat houses are near the river. The snow-covered marshland stretches almost as far as the eye can see, broken here and there by timbered ridges or tamarack swamps. One sees willow, tag elder, aspen, bur oak, spruce, Norway and white pine, red osier dogwood, sumac, and Phragmites. Tracks of snowshoe hare, otter, fox, small rodents, weasel, and other animals can be seen in the snow and signs of beaver are present in the woods. A number of bald eagles nest on the reservation. Magpies and snowy and great grey owls are not uncommon.

2.59 Outside the restored areas, extensive areas of marshland remain desiccated, barren and unused. Many thousands of acres pose a perpetual fire hazard. From 50,000 to 60,000 acres were affected by early marsh drainage and the Red Lake and Clearwater River channelization projects. To date, approximately 10,000 acres have been restored (see exhibit 22, page A-28).

2.60 Marsh Water Level and Quality: Greater control of the water level in Zah Gheeng Marsh is possible now than before the channelization project destroyed the marsh. Project documents call for flooding the marsh to a level of 1174.0 feet in the spring and maintaining this level until two weeks before freeze-up when the level is reduced to 1173.0. The base elevation of the marsh is 1172.5, so a small amount of water remains in the lower portions of the marsh during the winter. Normally 4 feet of water is required to keep the bottom from freezing, so the surface peat of the bog is expected to freeze. The low level of the surrounding land limits the operating range of the marsh to 1172.5 to 1174.0 feet. At present, high water levels are being maintained year-round for the benefit of fur-bearing animals.

2.61 The restored marshes have also been found to provide excellent spawning ground for northern pike. As a result, the marshes have, for the past 6 years, been put to use for the production of northerns.

2.62 Examination of the control structure (weir) at mile 178.8 on the Red Lake River by means of aerial photographs and during site visitations of January, 1973, reveals that effectiveness of the structure in restoring marshland is limited. Some of the marsh adjacent to the banks has been successfully restored. However this restoration does not appear to include all the riverside marshland (between the river and the nearest stand of timber). It had been hoped that the new control structure would restore all the upstream marshland adjacent to the river; in this light it seems to have achieved only partial success.

2.63 Since no data exist for Zah Gheeng, the water quality of discharge was assumed to be roughly similar to that of the Tamarack River (see exhibit 23). However, Zah Gheeng is not managed intensively. Higher concentrations of ammonia and total Kjeldahl nitrogen would be expected, but the other parameters such as hardness, alkalinity, metal ions, and phosphorus would be either reduced or remain constant (Lundberg and Trihey, 1972).

2.64 Endangered Species: A check with the U.S. Fish and Wildlife Service revealed that two endangered species are found in the area. The Eastern Timber Wolf is a permanent inhabitant of the area and the Arctic Peregrine Falcon frequents the area during its migrations. Present and proposed (status quo) operation and maintenance activities should have no effect on these.

2.65 Wildlife and Economy: Thousands of acres of former marshland still stand dry and relatively barren. Most parts of this land are unsuitable for farming or residence because they are occasionally flooded or threatened by fire. At one time it was thought that a more stable economy for the Red Lake Band of Chippewa Indians might be established by draining additional wetlands and encouraging tribal members to become farmers. Approximately 11 families living on the Reservation are now supporting themselves in this manner, mainly in the western part of the Reservation where the soils are generally drier and better suited for farming. Many residents of the Reservation live by harvesting in natural ecosystems, and consider the personal freedom this style permits them to be their most precious possession.

2.66 Reservation lands are used primarily for lumbering, trapping, wild ricing, hunting (for residents and non-residents), and fishing. Most residents are reluctant to establish motel businesses or other tourist attractions that would tend to keep outsiders on the Reservation, although some welcome the guiding business for hunting and fishing.

2.67 Although there appears to be little doubt about the fact that the restoration of the 3300-acre Zah Gheeng Marsh has been generally

successful, the muskrat population may not yet have responded to the habitat improvement. A lumber contractor and fur buyer for the Red Lake Band of Chippewa Indians considers the present season a poor one in terms of pelts taken, perhaps the lowest in 25 years, and does not expect as many muskrat pelts this year as last, when approximately 4000 muskrats were trapped. He has been buying pelts on the Reservation for 25 years and remembers years when he purchased 10,000 to 15,000 pelts during the fall to spring trapping season. One December he remembers having counted 8000 pelts. Although there are not as many trappers now as there once were, he is certain that individual trappers are unable to harvest as many furs as previously. Most muskrats are currently taken in the flowage near the outlets and dikes along the western edge of the Zah Gheeng Marsh to the western boundary of the Reservation. He, along with most other residents of the Reservation who were interviewed, would approve of further marsh restoration and believes that the furbearer habitat was far better before the original project was completed in 1951.

2.68 The buyer provided the following information regarding current pelt values; he considers the market to be "pretty good" this year (1973); muskrat, $2; mink, $18; raccoon, $4 to $5; and otter, $20. Waterfowl seasonal hunting licenses sell for $15 and he personally sold about 150 last fall (1972); many other licenses were sold by other authorized persons on the Reservation. Revenues for guiding were good last fall; that is, off-Reservation hunters paid $5 per day per person, party limits being set at six persons.

2.69 There was no deer season for hunters in 1972 and deer populations were reported to be low, a fact the buyer blames on timber wolves. Although he spends much of his time out in the wilderness because of his work, he reported seeing very few deer and stated that most of the Reservation's deer herd is seen around homes. When one drives around the Reservation, it is apparent from the number of carcasses hung in trees to age that residents are successful in harvesting deer.

2.70 Historical and Archaeological: No historical or archaeological features listed in the Federal Register as of February 1975 are affected by Corps of Engineers maintenance activities in the project area. The Minnesota Historical Society, the State Historic and Preservation Officer, has indicated that his review found no recorded sites of an archaeological or historical nature within the project area. However, a number of burial grounds are located in the area. It is anticipated there will be no effect upon them or the other potential sites due to present operation and maintenance activities. (See exhibit 9, page A-11). In addition, a check was made with the National Park Service that indicated no registered national landmark (national or historic) or any site considered potentially eligible for natural landmark (national or historic) status would be affected. (See exhibit 35).

2.71 Water Budget for the Culture of Wild Rice: During April, melting occurs and runoff water flows into the reservoir, normally increasing its level about 1 foot, usually from 1173.5 to 1174.5 feet. Some of the water that normally entered the lake through drainage ditches and streams is now used for the commercial cultivation of wild rice. Normally, the rice paddies are flooded in April to a depth of 4 to 18 inches and maintained at that level until early August when they are drained prior to harvest.

2.72 Upper Beltrami County is estimated to have 5000 acres of rice paddies in operation in the Red Lake drainage basin. The flooding of 5000 acres to a depth of 1 foot would cause reduction of 0.21-inch in the level of the reservoir. The paddies require additional water from April to early to August to replace the water lost through seepage and evaporation. This water is taken from surface water sources that enter Upper and Lower Red Lakes. Data taken from the U.S. Geological Survey Hydrologic Investigations, Atlas HA-346 sheet, estimate the average amount of water lost through evaporation to be 1.8 cfs of runoff per square mile, or 25 inches per year (Bidwell, et al., 1970). When average monthly evapotranspiration losses are used as a guide for the rice-growing season, April to early August, the estimated water loss in the paddies is about 16 inches. Most commercial farmers felt that seepage loss to underground aquifers was minimal because of the nature of the soil and the high ground water table in the area farmed. (If all the water lost through summer evaporation from the paddies had reached the reservoir, the increase in flow entering the reservoir would average 2.9 cfs during the 120-day rice-growing season, or be equivalent to 0.28-inch of water on the reservoir). During the August drawdown of the paddies, a maximum of 5000 acre-feet of water was discharged from the paddies to the streams entering the reservoir. This again would raise the reservoir about 0.2-inch, but paddy operators save money by not replacing the loss through evaporation during early August so that the actual discharge was estimated to be closer to 2000 to 3000 acre-feet.

2.73 The large size of the reservoir has prevented the paddies from becoming an important factor in water level management. The maximum fluctuation in reservoir levels caused by the culture of wild rice would be less than 0.5-inch during the year. As the industry grows, the average discharge from the reservoir will decrease slightly to maintain the lake between 1173.5 and 1174.5 feet. The development of the industry so far would have less than a 3.7 percent effect on reservoir inflow, even if all water used by the paddies was lost from the watershed. In practice, seepage through the dikes and August discharge have been returned to the surface water so that a 1 to 2 percent value would be more nearly correct. The industry would require a 10-fold increase before it would noticeably affect the water level management of the reservoir.

2.74 Water Quality of Commercial Wild Rice Impoundments: Weekly water samples were taken during the past 3 years from commercial wild rice impoundments. Studies were made on fertilized and unfertilized bog soil paddies; on fertilized and unfertilized mineral soil paddies and on the Ki-Wo-Say Wild Life Area along the Clearwater River.

2.75 The unfertilized paddies on bog soil within the Clearwater River portion of the watershed followed trends typical of irrigation water. Analysis of seepage and discharge water lost during the summer showed increases in total organic solids and dissolved solids. Twofold increases in ammonia and total Kjeldahl nitrogen were observed while decreases in soluble and total phosphorus occurred.

2.76 Near Waskish, a drainage ditch carrying water to the Tamarack River was used as a source of water for a 200-acre development consisting of mineral and bog soils. N-P-K fertilizers had been used at rates of 50 to 150 pounds per acre, and the drainage ditch received water from these paddies through dikes and over control weirs. Seepage of limited amounts of bog water not related to the surface water in the paddies had some influence on the quality since pH values observed within the paddies studied normally fell in the range of 7.8 to 8.0. Dissolved oxygen increased because of aeration from numerous rapids in the shallow creek. The water had been enriched in nitrogen and phosphorus compounds while flowing through the paddies. Changes in water quality are shown in exhibit 23, page A-29. Increases were noted in most parameters. During the 1971 growing season the drainage ditch discharge was approximately 0.1 to 0.2 cfs or about 1.4 acre-feet per week. However, the total discharge from the ditch and the development for the year, including fall drawdown, was close to 300 acre-feet. This water undergoes dilution in another drainage ditch and the Tamarack River, to the point that increased nutrient loads entering the reservoir would be difficult to detect analytically.

2.77 The actual environmental impact of paddies was difficult to assess since only a limited number of paddies and drainage ditches had been sampled. For example, one judicial ditch draining stagnant bog water had soluble phosphorus loads of 0.11 ppm, or 1.5 times that of the paddy discharge ditch. At the present time, paddy developments do not appear to pose a threat to water quality in the reservoir. The potential for a problem is there if large developments occur, since the holding capacity of Upper Red Lake is 323,400 acre-feet. If paddy development continues so that 10,000 to 30,000 acre-feet of paddy-associated water enters the lake, changes in water quality could occur. Some control of the type and the amount of rice development in the watershed should be considered to prevent over-use in relation to surface water resources and to water quality.

2.78 Present Water Quality of the Red Lake Reservoir: The results of the water quality sampling are shown in exhibit 24, page A-30. These parameters correspond to those associated with the commercial growth of wild rice in the watershed. All samples were collected, preserved, and analyzed in accordance with Methods for the Chemical Analysis of Water and Wastes, Environmental Protection Agency, 1971.

2.79 The lakes are currently classified as 2B or 3B by the Minnesota Pollution Control Agency. Class 2B, pertaining to fisheries and recreation designates the water as suitable: "to permit the propagation and maintenance of sport commercial fishes and be suitable for aquatic recreation of all kinds, including bathing, for which the waters may be usable" subject to certain limiting characteristics as described in the law. Class 3B, pertaining to industrial consumption, designates the water as suitable: "to permit their use for general industrial purposes, except food processing, with a moderate degree of treatment" again subject to limiting characteristics.

2.80 The reservoir appears to have sufficient nutrients to be a moderately productive lake. Its water is more turbid than most lakes found in the area; this is probably caused by its large size and the extensive shallow drainage from the large bogs surrounding the northern half of the reservoir. Both Upper and Lower Red Lakes appeared to be well mixed when sampled in mid-October, with surface and bottom temperatures equal, transparencies low, and dissolved oxygen high at all five sampling stations (exhibit 24, page A-30). Net phytoplankton showed a moderate diversity. The water quality of both lakes appeared to be good and the lakes had a high production potential.

2.81 Current Limnological Studies on the Red Lakes: The results of the cursory limnological sampling trips confirm the relationship between the lake surface area, the shallow mean depths, and the water quality (exhibit 24). The air temperatures were normal for the fall and this influenced the water temperature. The homothermal profile of water temperatures suggest that both lakes are well mixed. The brisk southeast wind present on 20 October 1972, would easily mix the waters at the shallow depths sampled. Also, the lower water temperatures encountered at Waskish and Shotley Brook may reflect the smaller size and shallower depths of the Upper Red Lake. The mean Secchi disk values suggest that on the dates sampled, Upper Red Lake was slightly more turbid. However, this is not supported by turbidity data in JTU (Jackson turbidity units) collected by Lundberg (1973) on the same date. (Lundberg reported just the opposite, with the Lower Red Lake having greater turbidity.)

2.82 Based upon the species composition of the net phytoplankton collected in both lakes, the water quality of the lakes appears to be good and the lakes potentially very productive (exhibit 26, page A-32). By using the same type of collecting net, researchers were able to compare data with those of Knapp (1960) from Lower Red Lake.

However, certain restrictions minimize the value of exact comparisons with Knapp's data. First, there are seasonal differences in the time samples were collected; Knapp sampled in the summer and North Star sampled in the late fall. Thus, more diatoms were found in the 1972 samples, in contrast to the higher proportion of green algae reported by Knapp. Another problem in comparing 1972 data with those of Knapp was that it was difficult to pinpoint the exact location of his sampling sites. Therefore, the samples may have been collected from slightly different areas.

2.83 According to Rawson (1956), a variety of algae species and a comparatively small number of varied blue-green algae species, such as were found in the Red Lakes, suggests the presence of mesotrophic conditions.

2.84 The most frequently occurring benthic invertebrate organism which was found at all the sampling stations was the midge, Tendipedinae (exhibit 27, page A-34). Other predominant forms which were collected at three out of the five sampling stations were the biting midge, Ceratopogonidae, taken at the Cut Off Road, Shotley Brook, and Waskish; the scud, Hyalella azteca, collected at the Red Lake River, Redby, and the Cut Off Road; and the mollusk, Pisidium, taken at the Red Lake River, Redby, and Waskish. The only location at which mayfly nymphs were reported was at Waskish. Caenis sp., a bottom sprawler, and Ephemera sp. and Hexagenia sp., both burrowing forms, were collected there.

2.85 The species composition of plankton and bottom-dwelling invertebrates has remained relatively unchanged over the years. The species of phytoplankton collected on 20 and 21 October 1972, showed some pronounced changes in species composition from the algal types reported by Knapp (1960). But these changes probably reflect differences in the time the samples were taken rather than changes in limnological conditions in the lake. A more meaningful approach to this comparison would require additional phytoplankton sampling during the maximum algal growth periods in the summer. The additional summer sampling program would also permit a check of the claim that the summer growths of algae are increasing and reaching nuisance proportions along the south shore of Lower Red Lake.

2.86 The types of bottom-dwelling invertebrates collected in the bottom samples of the present study are common in lakes in the northern regions of Minnesota. Because the precise locations of many of the invertebrate sampling stations which were part of the unpublished University of Minnesota study between 1949 and 1957 are not known, it is difficult to make any direct comparisons between the samples or to attempt to detect any quantitative changes which might indicate possible changes in water quality.

2.87 Land Use: The western part of the Red Lake Indian Reservation, which includes the Zah Gheeng and Ki-Wo-Say marsh areas, is Sub-Area 3 of the Red Lake Broad Program Area (BPA-2) discussed by the Soil and Water Conservation District Supervisors of Beltrami, Koochiching, Lake of the Woods, and Roseau Districts in 1967 (see exhibit 28, page A-35).

Essentially, it involves that part of the Reservation west of State Highway 89. This Sub-Area includes 250,000 acres of land used partly for agriculture, wildlife and forestry, with the remainder consisting of variously dry and wet bog. All of the land in this Sub-Area is owned and controlled by the Red Lake Band of Chippewa Indians.

2.88 In general, the soils of this area are organic (exhibit 29, page A-36) with scattered islands of mineral soils. Extensive peat deposits vary in depth from a few inches to many feet. There are small areas of high water table loamy sands 1 to 4 feet deep over clay subsoil in the northwest corner and 2 miles south of the northeast corner. South of these sands and along the north border of Sub-Area 3 are four areas of loam soil on top of glacial till. These areas involve about 17 square miles. Extending southward for 13 miles from the northeast corner is a sand and gravel ridge about 1 mile wide. To the west of this ridge is a belt of high water table sands, also about a mile wide.

2.89 Agricultural land is located in the extreme west and northwest portion of the Sub-Area. Further development could occur along the south side of the Red Lake River and in the northwest corner.

2.90 The area has great potential for wildlife habitat. The District Supervisors stated that 12,000 acres were being so developed in 1967 and that an additional 50,000 to 75,000 more acres were "in need of further development". Wild rice production is compatible with some wildlife habitat requirements and considerable potential exists for further development of this type. Hunting and guiding fees, wild rice production, and trapping income are economically important to the Red Lake Band of Chippewa Indians.

2.91 The eastern portion of the Red Lake Indian Reservation is Broad Program Area Sub-Area 4 and consists of 232,993 acres, mainly in timber. The Red Lakes are surrounded by high water table loamy sands more than 4 feet deep , which extend out on Ponemah Point and also in a 2-mile wide finger for 13 miles from the northwest corner. Organic soils make up the remainder of the land here with some loam and sandy loam soils on silty clay loam and clay loams. This Sub-Area is not cultivated but is the mainstay of the Red Lake timber land.

2.92 East of the Red Lakes is an area whose climate and peaty soils are well suited to forest production. The Tamarack River drains the land east of Upper Red Lake from an area dominated by Conifer Bog, with Black Spruce, the most important forest crop. Aspen-birch types

occupy the second largest acreage here. Most of the area is publicly owned, lying in Pine Island State Forest and supervised by the Minnesota Department of Natural Resources. Most of the private land is also forested. Cropland, open pasture, and meadow occupy only about 3,000 acres. The Tamarack River flows into the Upper Red Lake near Wakish, Minnesota. Beaver dams on the river and tributary streams and ditches in the watershed cause local flooding which is detrimental to good timber production. Northeast of Upper Red Lake, around Wakish, substantial acreage is in wild rice production (about 4,000 ac.).

2.93 East and southeast of Lower Red Lake the land is also peaty and poorly drained. Much of the land is publicly owned, including Red Lake State Forest. Again, most of the land, public or private, is forested, with aspen, birch, spruce and balsam as the main upland types (this is the Great Lakes Spruce-Fir Forest mentioned previously). Black spruce, cedar, and tamarack are confined to the lowland areas. Agriculture is limited. A few large beef herds and sheep can be found here. Beef feed lots are limited in numbers but are increasing throughout the area. The Battle, Cormorant and Blackduck Rivers drain the area, flowing into eastern Lower Red Lake. These lands were not significantly affected by the project.

2.94 West of the Red Lake Indian Reservation lies the non-Indian land most affected by project operations. This is the area in the Red Lake river floodplain above Kratka, on either side of the channelized reach of the river. It covers most of High Landing and Star Townships plus northern fractions of Deer Park and Hickory Townships and southern Goodridge and Teiner Townships in eastern Pennington County, Minnesota. Dominant soil types are peat and lake-washed till. Virtually all the land is privately owned farmland. About two-thirds of the farmland is cropland, with the remainder in woodland pasture, woods, brush, and marsh. Of the cropland, less than half is in cash grain crops, with the remainder in hay and pasture, or legumes such as sweet clover and alfalfa. This represents little change in the use of private farmland since before the project; however, most of the publicly owned lands of 1940 are now in private hands. The main cash grain crops, are in descending order, barley, oats, and wheat. The acreage of sunflowers for oil, confectionary, and bird feed is increasing. Livestock production is limited.

2.95 The drainage area upstream of the downstream end of the project, about 113 square miles (72,320 ac) is sparsely populated farmland with

no large population centers. Population of the area is decreasing. Exact population of the drainage area is not known; however 1970 census data show the following township populations:

U.S. Census, 1970

TWP	a. 1960 census pop.	b. 1970 census pop.	c. sq. mi. in drainage area(est.)	d. sq. mi. in TWP	e. est. drainage area pop.[1]
High Landing	(244)	209	34 1/2	36	200
Star	(251)	180	36	"	180
Deer Park	(182)	181	8	"	45
Hickory	(151)	96	23	"	61
Goodridge[2]	(63)	69	5 1/2	"	11
Reiner	(128)	101	6	"	17
Total			113		514

This shows a population density of *about 4 persons per square mile.*

2.96 Downstream of the project the river valley deepens and the effects of reservoir flood control operations are small or marginal. The principal areas of concern are western Kratka Township, and the city of Crookston. The former is a rural area adjacent to and similar to the drainage area described in preceding paragraphs. The latter is much farther downstream. A third of the town lies in the floodplain. Emergency levees have been built by local interests to protect low-lying areas. By the time flood waters reach Crookston, however, the percentage of streamflow attributable to releases from Red Lake is typically less than 5 percent.

2.99 Downstream Anticipated Water Supply Demands: Downstream of the Red Lake Dam water supplied by the Red Lake River will be used for (in descending order): irrigation, municipal, industrial, power, and livestock. Except for the drought years of the 1930's, the natural streamflow has been sufficient to supply all these needs. Irrigation use is increasing, with demand peaking in summer. Only the cities of Crookston, East Grand Forks, and Thief River Falls draw water from the river for water

1. $e = bc/d$.
2. Does not include Goodridge village, which is not in drainage area.

supply, and their demands are fairly stable. Industrial use of water at present is heavy but decreasing. The water is used by potato and sugar beet processing plants, most of which are in Crookston and East Grand Forks. Sugar beet plants are converting to a closed system in which water is recycled. This will greatly reduce industrial water supply demands. Water demand by power plants is relatively small, and will be further curtailed as plans to import power from outside areas are implemented. Livestock water demands are also relatively light. Altogether these damands amount to about 15-20 cfs . The Red Lake Reservoir's typical maximum discharge is 1,000 cfs. The reservoir appears capable of supplying present and future projected water supply needs of downstream communities.

2.98 Beef Production: Beef production is the major agricultural enterprise in the eastern extreme of the Red Lake basin and present trends indicate a marked increase in future production. To date there have been approximately 7,800 acres of marginal woodland cleared for pasture improvements. Presently there are approximately 27,000 acres of land cultivated for forage crops with a yield of 1.9 tons per acre (Minnesota Department of Agriculture, 1971; Gillman, personal communication, 1972). Estimates made by the Bemidji Agricultural Stabilization and Conservation Service indicate that in excess of 35 percent of Beltrami county's 22,700 head of beef and dairy cattle are found in the watershed east of Upper and Lower Red Lake. The majority of the livestock is beef cattle with only a few small dairy herds located in the area.

2.99 The Indians and Wild Rice: The Red Lake Reservation reports 300 acres of wild rice stands on tribal lands. The majority of rice is concentrated in the southwest corner of the reservation near the Clearwater River (T150N-R-36W and R-37-W). The amount of green rice harvested annually on tribal lands is about 7,500 pounds with the harvest being conducted by an average of 25 ricers. At least 150 Indians leave the reservation each year to rice on non-tribal lands (Edman, 1970).

2.100 During 1972 approximately 10,000 pounds of green rice were harvested from 66 acres of paddies located adjacent to the Ki-Wo-Say Wild Life Area on the western border of the reservation (Jorgenson, personal communication, 1972).

2.101 At the present time the control structure located at the outlet of Lower Red Lake in no way affects the operation of the paddies located on the Ko-Wo-Say management area and does not appear to have any influence on natural stands (Thompson, personal communication, 1972).

2.102 Cultivated Wild Rice: There are approximately 8,000 acres of private wild rice paddies located in the Red Lake River sub-basin. The greatest acreages (about 4,000) are located on non-Indian land to the north and east of Upper Red Lake around Waskish, Minnesota (Lundberg and Trihey, 1972).

The discharge from these paddies flows into Upper Red Lake through a series of drainage ditches, or via these ditches to the Tamarack River, then to Upper Red Lake. Battle River and Shotley Brook also carry some paddy discharge.

A second major rice producing area is located south and west of Lower Red Lake, in Clearwater and Polk counties. Private developments totaling 3,000 acres border the Clearwater River with minor developments occurring along the non-Indian portion of the Red Lake River.

2.103 These areas were the first in the State to experience the rapid expansion of the wild rice industry. Commencing in 1965, paddy acreage began to double annually, resulting in an increase in land values from 5 dollars per acre to over 100 dollars per acre for flat bog land adjacent to an adequate source of water. At the present time development costs average about 500 dollars per acre and, as a result, the new rice industry has made a significant economic impact on the area (Hanson, personal communication, 1972).

2.104 Recreational Use: Upper Red Lake has always been known as an excellent lake for sport fishing for walleye. This has resulted in an expanding tourist and resort industry located on the northern and eastern shores of Upper Red Lake. According to the county extension office, there has been increasing use of these areas for other recreational endeavors, namely hunting and snowmobiling. This is primarily because of the large tracts of land in public ownership in the area (Hanson, personal communication, 1972).

2.105 At present there are six resorts near Wakish, plus a State forest campground with access to Upper Red Lake. These areas are somewhat affected by changes in lake levels.

3. RELATIONSHIP OF THE PROJECT TO FUTURE LAND USE

3.01 The population of the Reservation at Red Lake has grown considerably since the beginning of the Corps project. In 1949 there were about 2100 people living on the reservation; today there are about 3500. The self-governing enclave is not open to free immigration or outside ownership of the land. Its population is affected only by the rate of birth, death, and emigration, of which the first has well exceeded the latter two. Thus a limited amount of land (and lake) is available to support a growing population. As a result, development plans for the future emphasize greater productivity.

3.02 In 1967, the Soil and Water Conservation District Supervisors of Beltrami, Koochiching, Lake of the Woods, and Roseau Districts suggested that about 30,000 acres, including much dried out marshland, could be profitably leased for cattle grazing. The tribe was willing to lease the property to outside interests; however, no genuine offers were ever made.

3.03 The Fish and Wildlife Service, U.S. Department of the Interior, suggested that dried-out marshes could be restored by a series of gated impoundments (see exhibit 30, page A-37). The plan, as it is, needs further refinement. Necessary topographic information is unavailable, and certain engineering information would have to be obtained prior to any firm plans. This would include horizontal and vertical control for the dikes and control structures. The plan could be implemented piecemeal with new impoundments being built as funds become available. The Corps project would not affect such a plan.

3.04 The Tribal Council, under Chairman Roger Jourdain, governs the reservation and has authority over land use on the Reservation. The Council's development plans are for (in order of priority) fisheries, ricing, and marsh restoration. Funds are being presently applied in the commercial fishing enterprise. Next in priority is the Council's plan to convert as much as 30,000 acres to wild rice production. Though local interest in conventional dry-land farming is low, the people have been harvesting wild rice for centuries. The lands designated for future ricing lie mostly between the Clearwater and Red Lake Rivers, including some dried-out marshland. The paddies could be supplied with water directly from the reservoir through lift pumps and diked ditches, or by diversions from the existing marshes during the rice-growing season. Such a development is not expected to significantly affect the existing project, so long as the reservoir, restored marsh, and rice paddy operations are adequately coordinated. Considerable capital expenditures are needed for development and no funds are immediately available for that purpose. Any concerned agency desiring to implement a restoration plan should take care to see that such plans coincide with the overall land-use plans of the Tribal Council.

3.05 In the agricultural area downstream of the Indian Reservation, farms enjoy the benefit of less frequent flooding and improved drainage. In the past some of the unused land was plowed to take advantage of the improved conditions. Rising farm prices may yet bring about further agricultural development; continued operation of the project in the present manner, however, will not.

4. THE ENVIRONMENTAL IMPACT OF THE PROJECT

Identification of Impacts

4.01 Because the life style of the Red Lake Indians is closely integrated with the natural ecosystems, the natural and cultural systems will, in most sections, not be treated separately. Where they are, the results of interviews with tribal leaders and other members will follow the sections describing the direct impacts on nature. A detailed account of the interviews conducted is on file in the St. Paul District Office.

4.02 Impacts of the project on natural and cultural systems include the following:

Impact of the project on fishing

- Fish production
- Fish ladder trial
- River sport fishing

Impact of the project on water quality and water levels

- Water quality
- Lake level effect on water quality
- Fish production
- Wild rice production
- Recreational opportunities

Impact of the project on trapping, hunting, and guiding

- Channelization effects
- Drainage effects
- Wildlife
- Cultural and economic systems

Impact of restoration efforts

- Reflooding of the marsh
- Concrete weir
- River water quality
- Fish ladder
- Tribal residents

Impact of the dam on ricing

Impact of the project on recreation

Impact of the project on agriculture

Impact of the project on urban areas

Impacts of the Project on Fishing

4.03 Fish Production: Reliable records of fish production in the Red Lakes have been kept since 1930. However, marked fluctuations of the catch, both before and after the building of the dam, make interpretation of the causes for these changes extremely difficult. Abundance of the most important commercial fish--the walleye--for instance, has shown large and irregular fluctuations (see Exhibit 12), with a sharp drop in 1971 and 1972 to less than half the usual catch.

4.04 Several attempts have been made to determine the effects (if any) of reduction of lake levels on the spawn (eggs) of lake whitefish, Coregonus clupeaformis, by Smith (1973). Spawning takes place in shallow water (2 to 3 feet deep) in October and November, and young hatch in March. During this time, the eggs need dissolved oxygen and protection from freezing and mechanical damage. There is a hypothesis that the impact of heavy ice on the spawning beds may destroy the whitefish eggs, but this has not been substantiated.

4.05 Although special field studies may have to be made in order to establish with greater certainty the causes behind these changes in fish production, most of them appear, after careful consideration of currently available data, not to be directly related to the presence of the Red Lake Dam.

4.06 Concerns of Red Lake Indians Interviewed: Interviews with tribal leaders and members, and census data show many of the difficulties in obtaining employment on the Reservation from time to time. Because this interviewing happened to be conducted immediately after two very poor fishing years, the topic of the lack of fishing success and its causes was uppermost in the minds of most of those interviewed. Had the study been conducted during another year, this topic may have received less emphasis.

4.07 Questions were raised by Indians concerning the role of the dam at the outlet of Lower Red Lake in permanent out-migration of fish into the Red Lake River. It has been suggested that the dam restricts the reentry of fish that have entered the Red Lake River to spawn, which in turn is responsible for the decline in walleye production. The lower production is then reflected in the CPE, which reached its lowest levels in the history of the fishery in 1972.

4.08 Fish Ladder Trial: In response to many such complaints in the early 1950's, a fishway was built by the Corps at the dam (U.S. Department of the Army, 1957a). Netting of fish coming through the fishway in 1954 and 1956 to spot check its effectiveness revealed that the fish using it were almost entirely undesirable species. Due to its design and the wide fluctuations in river level, the lower end was often out of the water below the dam. The Bureau of Indian Affairs superintendent and the Corps of Engineers then

decided it was a waste of time. The fishway was then abandoned, and no further studies have been conducted since.

4.09 The dam probably has little effect on production of walleyes. According to Smith (1972) the Red Lake River is of comparatively little importance in walleye spawning activity. Smith also reported that, on the basis of results of tagging studies conducted in 1949, 1950, and 1951, the Tamarack River on the Upper Red Lake and the Blackduck River on Lower Red Lake are the most important spawning streams for walleye in the spring. They are also the two largest rivers emptying into the lakes (see exhibit 7).

4.10 Perceptions of Tribal Members: The effects of the dam on fish harvest, as perceived by the tribe, are significant. Many, and perhaps the majority, of the tribal members and tribal authorities believe that the dam is taking away fish and minnows which rightfully belong to the lake. They appear to be frustrated and angered by the inability of the fish to return to the lake.

4.11 One cannot definitely establish the effect of the dam on fish harvest on the basis of the interviews or data recently collected. The effects of the dam on the culture and economy of the tribe would be considerable if there were a relationship, but these data do not show a decrease in fishing that can be attributed to the dam.

4.12 Red Lake River Sport Fishing: The smaller size of sport fish now caught below the outlet in the Red Lake River may have been caused by the straightening of the channel and the consequent increasing of current velocity and reduction of favorable habitat for fish and fish food. The detrimental effects of channeling on wildlife, particularly aquatic life and fisheries, has been well-documented in the literature (Reed, 1971; Henegar and Harmon, 1971). Very limited operation and maintenance construction work has been accomplished on the channelized stretches and thus the stream fishery has probably received little further degradation since original project construction.

Impact of the Project on Water Quality and Water Levels

4.13 Water Quality: The water quality of both lakes appears to be good, although both past and present scientific data are not sufficient to support a conclusive assessment (see exhibits 14, 24, and 25). Although constant mixing by winds keeps the water turbid, it also maintains high dissolved oxygen levels. The lakes appear to be moderately productive, probably an optimum condition for their location and use. Their potential productivity is probably greater, considering the results of phytoplankton data (exhibit 26). Nutrient levels (nitrates and phosphates) indicate an improvement in water quality since 1932, probably due to a removal rate (in fish) which balances their influx from the drainage basin.

4.14 If the data reported in 1932 for phosphorus and nitrogen compounds are compared with the results from analyses in 1972, the improved water quality of the reservoir can be shown. Closer agreement was observed

between the 1962 and 1972 data but phosphorus, ammonia, and total Kjeldahl nitrogen were not available for 1962-1972 for comparison. The calcium, magnesium, hardness, and alkalinity fell within expected seasonal variations for all three dates. Dissolved solids decreased from 1932 to 1972, but a trend was not observed for all major ions. Sharp decreases in potassium and sodium occurred from 1932 to 1964-1972. For these years the chloride ion decreased while sulfate increased.

4.15 The 1932 surface water value of 5.4 ppm $N\text{-}NO_3$ was difficult to interpret unless the sample was taken near a source of contamination or improperly preserved prior to analysis. Three years of water sampling in the Red Lake Watershed during the growing season, but not on the reservoir, have failed to produce a nitrate nitrogen value greater than 0.5 ppm.

4.16 Responses of Tribal Members Interviewed: In contrast to this assessment, well over half of the residents interviewed reported that water quality had changed for the worse over the years. Although this negative effect was not usually associated with the dam, some respondents, especially tribal leaders, reported the belief that the dam contributed to the lowering of water quality. Usually the connection was made with the lack of flow-through or stagnation. One tribal leader, however, blamed the lower water quality on pesticides and fertilizers being used in rice paddies. When questioned about the effect of lowered water quality on themselves, interviewees mentioned these areas: swimming, "greening" of the fishing nets by algae, drinking lake water, and the presence of dying fish.

4.17 Water Levels and Flood Control: Records of lake levels have been kept since 1921, although the record before 1933 is incomplete. The dam itself was completed in 1931. Regulation of the discharge between 1931 and 1951 was aimed only at regulating lake levels. Even so, this operation appears to have been indifferent or ineffective. Limitations of the data are such that long-term comparisons are difficult to make.

4.18 After 1951 the Corps project was actually expected to reduce the frequency of high and low lake elevations although this was not one of the project's original purposes. A study was made in 1945 of lake levels which would have occurred during the period of record of lake stages (1921-1945) for the proposed operations in generally increasing low stages and reducing the extreme levels the lake could reach while providing flood protection and increasing low flows for water supply and pollution abatement. High stages would have been reduced appreciably, mainly because of the higher releases made possible by the improved channel and the outlet. There were also cases where maintaining near-normal lake levels when lower-than-normal stages actually prevailed would have paved the way for higher summer stages (following heavy rains) than actually occurred. The opposite situation could also have occurred, where maintaining near-normal levels before a dry spell could have brought on an unnatural low level. Such occurrences, however, would have been rare in comparison to those times when abnormal high and low stages would have been modified. Other factors tending to raise the level of the lakes above normal include the closing of the outlet gates for downstream flood relief, or limiting the

discharge to 1000 cfs. on those rare occasions when the uncontrolled outflow would have been greater, are more than commpensated for by the advantage of being able to maintain a 1000 cfs. discharge most of the year. Records since 1951 tend to confirm these predictions.

4.19 The flood control program itself appears to have been beneficial. During several floods since the start of reservoir operations, discharge at the dam was held down to reduce flood damages downstream, without any major damages resulting from temporarily high lake levels. Operation for downstream water supply has been rare, and has produced no water level reductions of any significance.

4.20 Effect of Lake Levels on Water Quality: Since the control structure has not altered the range of natural lake levels, it is unlikely that this structure has had an effect on the quality of the water. The only changes that may have occurred are the changes that are found in the natural aging of all lakes or slight changes by the more rapid drawdown of high water levels caused by operation of the control structure. However, the operation of the reservoir above 1174.5 feet could alter water quality by partial flooding of low wild rice land containing pesticides and nutrients along the north shore of the reservoir. The operation of the reservoir at a higher fixed level would have less of an impact than operating at fluctuating higher levels where the marshes' tables would increase and periodically be discharged into the reservoir.

4.21 Perceptions of Tribal Leaders and Members: It should be noted that although most tribal members felt that water quality had deteriorated over the years, they did not, except in a few cases, seem to connect this deterioration with the dam.

4.22 Changes in the Fishery Caused by Water Level Fluctuations: Because the climatic factors which influence the year class strengths of walleye populations are particularly influential in the early spring (April and May), the relationship between the pool elevations in a single year and the production of fish five years later than that year were examined. A check of these data suggest that there was no consistent relationship between the evaluation of the pool at the time the fish spawned and the abundance of these fish at the time they first entered the catchable stock of the fishery. Therefore, fluctuations in water levels do not appear to have affected the size of walleye populations.

4.23 There are, at present, still many unanswered questions about the effect of water level reductions on whitefish spawn in the shallow water areas of the lakes during the winter and early spring. However, no opportunity to do the necessary investigation to develop the necessary data has been available to date. Before concluding that its effects are harmful, research on the impact of lowering pool levels should be undertaken.

4.24 The ease of going out on the lake to fish is affected by water level. The lowering of the water level in the lakes makes boat launching very inconvenient, as the water moves a relatively great distance out for every small decrease in elevation of the water surface.

4.25 Water Level: Perceptions of Tribal Members: Most Indians appear to see a direct connection between problems with water level and the Red Lake Dam. High water levels are associated in the minds of many tribal leaders with a deterioration of water quality in the lake. Low water levels result in problems for the fisherman. Fluctuating water levels may affect trapping, ricing, and spawning of many species of fish.

4.26 Changes in Wild Rice Production: Construction of the dam and channelization of the river for 3.2 miles below the dam did not alter the wild rice production in the area affected by the changing water levels. It did reduce the potential to grow rice in the marshland, but it is probably true that little or no rice grew there before the start of the two Corps projects. After the marsh was restored for 3.2 miles downstream from the outlet of Lower Red Lake, a limited attempt to introduce wild rice met with very little success. Within the reservoir wild rice was not important prior to the project and has not changed since the dam and channelization were completed.

4.27 Effect of Rice Paddy Drainage on Lake Water Quality: Studies on water diverted through the Ki-Wo-Say Wild Life Area (where numerous rice paddies are located) from the Clearwater River on the western edge of the Red Lake Indian Reservation have shown that the discharge water was reduced in solids, phosphorus, alkalinity and hardness, but increased in soluble and total Kjeldahl nitrogen. No soil disturbances or major changes in water levels occurred in the bog area. However, studies of bog soil rice paddies have shown that the submerged soils become anaerobic during the summer. This also appeared to be true for seepage water from a large bog near Waskish where surface dissolved oxygen averaged 2.4 ppm for the summer. Seepage water from the paddy soils and from the bog contained increased nitrogen and phosphorus loads. This was also clearly demonstrated in the paddy water when the peat soils were disturbed by mechanical thinning of the rice (Polfiet, 1972).

4.28 If the reservoir flooded the bogs early in the year and drained them during late summer or fall, increased nutrient load in the form of ammonia nitrogen and phosphate-phosphorus would be expected in seepage water returning to the lake by drainage ditches. This could also occur if drawdown occurred in the winter after the flooded swamps had an ice layer on them. The shallow water under the ice rapidly becomes anaerobic and nutrient loads would increase. Studies of summer seepage through a bog drainage ditch indicated that ammonia concentrations near 1.5 ppm and phosphorus concentrations near 0.1 ppm would be expected. Normal aerated surface water runoff from the bog was high in ammonia but low in phosphorus.

4.29 Effect of Ditching: The extensive ditching work done prior to 1930 on the bogs to the north of the reservoir under the misguided idea of increasing farmland may have had a greater effect on water quality changes in the area than any other factor by introducing nutrients and humic acids produced by normal anaerobic decomposition.

4.30 Changes in Recreational Opportunities: Operation of the dam on Lower Red Lake could significantly affect the operation of resorts on Upper Red Lake. Any significant drop in water levels below 1174 would result in serious navigational problems on Upper Red Lake which also affects recreational use of the reservoir. Upper Red Lake has extensive shallow areas near Waskish which could become problems for operation of boats with outboard motors. Past rises in lake levels flooded out a few good camping areas once used regularly by commercial fishermen. Because of the low relief of the land there, no other easily accessible places to camp have been found along the north shore of Upper Red Lake.

Impact of the Project on Hunting, Trapping, and Guiding

4.31 Channelization Effects: There can be no doubt that the channelization of the Red Lake River was partially responsible for the desiccation of thousands of acres of marsh which were predominantly excellent wildlife habitat. There seems to be no record of exactly how much marshland was actually affected, but a conservative estimate appears to be at least 20,000 to 25,000 acres. Some drainage was sanctioned by the Tribal Council of the Red Lake Band of Chippewa Indians and the Bureau of Indian Affairs in the belief that the availability of farmland might encourage some Indians to take up farming and thus help stabilize the economy of the Band. However, resolutions passed by the Tribal Council (see exhibits 31 through 32) leave little doubt that the Indians allowed the Red Lake Project construction in the Reservation only on the condition that most of the marshes would remain in their generally flooded condition. Fifteen years later an attempt was made to restore a portion of these marshes to a semblance of their original state.

4.32 This restoration of approximately 20 percent of the original marsh has been remarkably successful. However, such adverse conditions cannot be expected to mend within the interval of 6 or 7 years, and continued reevaluation and study of the affected areas is certainly advisable.

4.33 Unquestionably, the environment described by Errington would have undergone alteration simply because of changing patterns of human use. Although drainage of lands in the northwestern part of the Red Lake Indian Reservation had occurred or would have occurred anyway, there remains also no question that the marshes adjacent to the Red Lake River east of mile 178.8 were drained in conjunction with its channelization between 1948 and 1952.

4.34 Effects on Wildlife: It is extraordinarily difficult to assess the status of wildlife on the Red Lake Indian Reservation. Fluctuations in numbers of muskrats may or may not be meaningful, for record-keeping may not be accurate, the price of pelts or number of trappers varies from year to year, and, even if other factors remain constant, it is known that muskrat populations fluctuate (Errington, 1962). Errington considered the Red Lake Reservation to have the best muskrat population along the Red Lake River when he visited the area in 1920 (see Aesthetic Value 2.6 Environmental Setting). It does appear that there has been a tremendous decline in muskrat populations since 1951, and that, although populations may be rising, the low harvest this year (1972) suggests that such may not be the case. The low numbers of deer also pose problems. (Is hunting pressure too great, are habitats becoming unsuitable, or is some unknown factor operating, such as disease? If one were to guess, one would perhaps choose the first two alternatives, but it is clear that additional data are needed to be certain.)

4.35 The decrease in marsh habitat must certainly have affected waterfowl populations, especially during the breeding seasons. Although no records have been located in reference to such populations, it is virtually certain that 20,000 to 25,000 acres of marshes must have provided brooding territory for thousands of ducks, geese, and other waterbirds. Restoration of part of the marshes may be beneficial for waterfowl unless extermination of breeding and brooding populations occurs to such an extent that birds native to the area are exterminated and "outsiders" move in, only to be exterminated also. The need for wildlife management is great.

4.36 Effect on Cultural and Economic Systems: There appears to be direct connection between loss of trapping income and the work done on the Red Lake River by the Corps of Engineers. It is important to note that tribal authorities and members perceive a direct connection and appear to hold the Corps responsible for the loss of habitat, and hence, loss of fur harvest and income.

4.37 Responses to trapping questions were not as emotional as those connected with fishing. This may be because the connection between the construction of the dam and the effect on trapping can be made logically and rationally by members of the tribe.

4.38 Loss of income from guiding and from shooting waterfowl probably resulted directly from the draining of the wildlife habitat that was caused by the work on the Red Lake River. Restoration of wildlife habitat with efforts to restore wildlife, especially waterfowl, would have a positive effect on the attitudes of the residents. The strength of residents' negative beliefs and perceptions appears to be directly related to income sources.

Impact of Restoration Efforts (Marsh Reflooding)

4.39 Reflooding of the Zah Gheeng Marsh: The marsh restoration project in the Zah Gheeng area near the outlet has been successful in returning approximately 3300 acres to wildlife habitat and has thus reduced the detrimental impact of the earlier project. This is approximately one-sixth of the former extent of the marsh. The remainder of the Zah Gheeng Marsh area is now practically unproductive and useless: often too wet to farm, usually too dry to support vigorous waterfowl and fur-bearer populations, and a potential fire hazard.

4.40 A survey and plans drawn up by the United States Fish and Wildlife Service suggest strongly that 10,000 to 15,000 acres of presently dry marshes could be restored to a semblance of their original state by the erection of low dikes and use of outlet controls for the extensively drained marshes east and west of the large "off-take" drainage ditch extending northward from the Red Lake River at mile 175.5 to State Highway No. 1. (The "off-take" ditch receives some water from an area north of State Highway 1 which has been developed as wild rice paddies.) By raising the level of the road along the ditch, building dikes along four presently drained areas (two on the east side of the road, two on the west side), and equipping the dikes with control gates, approximately 10,000 acres could be inundated under 2 feet of water. The areas involved are in townships 152 and 152N, ranges 37 and 38W. It is assumed that wildlife habitat would be significantly improved by such a project, and downstream flow of waters which enter this area from the north would be better controlled.

4.41 Concrete Weir on the Red Lake River: The original control structure at mile 178.8 on the Red Lake River was built in 1951. This rock and brush weir was designed to maintain high river levels upstream. However, in a few years the failure of this structure was evident. Settlement and erosion had rendered the structure ineffective; low river stages and the draining of adjacent marshes had been the result. As a result, the Corps of Engineers rebuilt the structure in 1958. The rock and brush weir was replaced with a concrete weir which, it was expected, would resist settlement and erosion, and which, according to hydraulic analysis (U.S. Department of the Army, 1957b, page 9) would raise the river to levels equal to or higher than natural river levels in the unchannelized reach immediately upstream. Following inspection by the Corps of Engineers and other personnel in 1963 it was reported that the structure had been effective in restoring the marshes adjacent to the river in the unchannelized reach (U.S. Department of the Army, 1965, paragraph 13). This opinion was also expressed by the U.S. Fish and Wildlife Service and the Bureau of Indian Affairs (U.S. Department of Army, 1965, Appendix E).

4.42 In 1973 the contractor (North Star) reported that this was no longer true. In its report to the Corps of Engineers, North Star said,

"Examination of the channel control structure (weir) at mile 178.8 on the Red Lake River by means of aerial photographs and during site visitation in January 1973 raises questions as to the purpose of this structure. It appears that the weir succeeds in raising the water level to the extent that it broadens the river bed to the east, but it does not contribute significantly to restoration of marshes north and south of the river bed. Several residents and persons acquainted with the area stated that adjacent marshes are affected only slightly by the weir."

This view is also shared by University of Minnesota Agricultural Extension Agent Floyd W. Jorgensen, who has been operating the regulated marshes for many years. At the present time, the reasons for this apparent deterioration of conditions has not been determined.

4.43 Impact on River Water Quality: Operation of the water level of the marsh at a fixed level would probably not have a detrimental effect on the water quality of the river. Some changes similar to those cited in the sections on water level and water quality of the reservoir could occur. Ammonia and total Kjeldahl nitrogen would be expected to be high, but phosphorus, total solids, and metal ion concentrations would not be expected to increase.

4.44 Impact on Tribal Residents: Efforts to restore the land to its original condition are noticed by tribal leaders and residents and are an important determinant of their attitudes toward the dam. Such efforts indicate to many tribal members that the Corps is concerned with rectifying what they consider to be wrongs done to their reservation.

4.45 Several of those interviewed mentioned efforts that had been made toward remedying two of the negative effects of the dam. In particular one project was mentioned--the reflooding of part of the area to restore it as a wildlife area (called the Zah Gheeng Wild Life Area). Some expressed confidence that these efforts are restoring much of the wildlife, ducks, muskrats, and mink whose numbers were severely depleted with the loss of the marshland.

4.46 Others, however, felt that the restoration effort encompasses such a small area that it is "almost meaningless". They consider the fish ladder to be particularly ineffective, and some expressed the idea that a bypass should be constructed so the fish could get back to the lake from the river. Generally, however, people seemed to feel that the effort to restore the wildlife area was commendable and generally successful, but inadequate in extent.

Impact of the Dam on Ricing

4.47 Since the reservoir and the marsh area were not significant rice-producing areas prior to the construction of the control structure and channelization of the river below the outlet, it is probable that only minor effects were felt on ricing.

4.48 Most tribal members interviewed appeared to consider ricing as an unreliable source of income. However, many members were interested in commercial ricing, which is a relatively new economic venture, and seem to feel the connection between water level and commercial ricing was a technical question. The effect of the dam on natural ricing is perceived by tribal members as minimal.

Impact of the Project on Recreation

4.49 Most of the residents of the Red Lakes area stated that they did little or nothing in the way of recreation. The most frequently mentioned activity was sports such as baseball and basketball. A few Red Lake Reservation residents mentioned swimming as a customary recreational activity; none mentioned boating as having a recreational aspect. Fishing for most Indians is seen as a source of income and, therefore, is not generally considered a recreational activity.

4.50 Although the impact of the dam on recreational activities of the tribal members has not been great, some members of the tribe believe it has negatively affected recreation. Some tribal members believe the dam is responsible for poor swimming conditions because of low water quality. However, biologists see no connection between the dam and water quality.

4.51 Before the river was straightened, it was not as accessible to fishermen as it is now. The banks along the river now provide easy access to the river. Permits to fish are now sold to non-Indians. Although there are still many fish in the river, it was stated that fishing is not as good as it was before the project was completed, and that the fish caught now are much smaller. Several members of the tribe believe that either the dam or the river straightening significantly affected sport fishing in the Red Lake River. With this one exception, recreational changes appear to be unrelated to the existence of the dam.

Impact of the Project on Agriculture

4.52 The immediate benefits of the project included the protection from 10-year frequency floods of about 15,000 acres of cropland along the Red Lake River and 21,000 acres along the Clearwater (see exhibit 34). Total cropland receiving some degree of potential flood damage reduction totaled about 25,000 acres along the Red Lake River and 44,000 along the Clearwater. The original project also improved local drainage and promoted agricultural development. Development in the Red Lake River drainage area took place in the eastern third of Pennington County, Minnesota, and on the western edge of the Red Lake Indian Reservation. The extent of this development has not been accurately quantified. On the Reservation only a handful of farms were developed. In the Pennington County area, however, in about 72,000 acres of drainage area, about 2/3 of this total is now cropland, or about 48,000 acres, most of which benefits from flood reduction and/or improved drainage.

4.53 Measuring these benefits in 1974 dollars is difficult. It was estimated (circa 1950) that the original project would reduce annual flood damages from $30,700 to $4,800. At late 1973-early 1974 farm price levels this would amount to a reduction from potential annual damages of $69,000 to $10,800, an annual savings of $58,200. This figure, of course, does not consider the post-1950 development of unused land due to improved conditions. A conservative estimate of all present flood-control based on the facts that (1) land use on privately owned farmland is about the same as before the project, and (2) the amount of land now in private ownership has increased by a factor of approximately 16 percent[1], yields a value of $67,500 in estimated present annual benefits. A similar analysis of benefits along the Clearwater River shows an estimated annual benefit of $82,000. A conservative estimate of the total flood control benefits for the project, then, would be around $150,000 per year.

Impact of the Project on Urban Areas

4.54 The cities of Crookston, East Grand Forks, and Thief River Falls have relied on the Red Lake River for water supply since before the project began. River water is also needed for industry and power in these cities. The surrounding farmland uses the water for livestock and irrigation. Since 1951 the natural streamflow of the river has surpassed these demands. However, there were years (in the 1930's) when the supply of water was insufficient. In recent years there have been rare occasions when river flows were extremely low, although never less than the demand. This had aroused considerable amount of concern among city governments and industries which use the water. Thus, while no water supply benefits have been tallied for the project, the potential of such benefits accruing in the future exists, and is greatly appreciated by the potential benefactors.

4.55 Pollution abatement is another goal of project operations. In addition to agricultural sources, the cities of Crookston, Fisher, Red Lake Falls, St. Hilaire, and Thief River Falls discharge treated sewage into the river. During periods of low flow the potential exists for significant deterioration of water qulaity in the river. Such deterioration is a potential threat to downstream municipal water supply, as well as channel environment. Although streamflow augmentation has not been needed in the past, the potential benefits of this aspect of project operations is understood and appreciated in the cities that rely on river water for drinking, or use the river as a recreational resource.

4.56 The city of Crookston has a flooding problem. One-third of the town is situated in low flood-prone areas. Levees now protect many of these areas to a certain extent. Damage is usually confined to basement

(1) 1939 private land ownership 85.8 pct, vs. 1970 pvt. ownership 98.5 pct.

flooding in these low areas. If a major flood were to hit the city, a reduction in discharge at Red Lake might be of some help. However, the effects would be slight. Outflow from Red Lakes does not contribute more than 5 percent of the total streamflow at Crookston during a major flood.

5. ADVERSE ENVIRONMENTAL EFFECTS WHICH COULD NOT BE AVOIDED

Original Project:

5.01 The more long-lasting impacts of the original project have been identified and discussed at some length in preceding sections. These include the extensive drainage and destruction of marshland habitat, the decline of sport fishing on the Red Lake River, decrease in waterfowl and wildlife population, decreases in hunting, trapping, and guiding, and the income derived therefrom by local residents. Channel sections that were cut off by channelization underwent a permanent environmental change (river to pond), as did those areas where a new channel was cut (pasture, woods, etc., to river). These environmental changes could not have been avoided without making major changes to the original project plan.

5.02 There were also short-term adverse impacts of the project. The plant and animal communities which were disrupted by construction activity have since recovered, except in those areas where their habitat was permanently altered. Some of the marshes which were dried out have been restored. Temporary air and water pollution created by heavy machinery have dissipated without leaving permanent damages. It should be noted, however, that despite the general recovery of river and bank ecology, some of the scenic value of the wild river was permanently lost to channelization.

5.03 In view of the adverse environmental impacts caused by the original project, it is understandable that a generally negative attitude toward the project persists among the residents of the Red Lake Indian Reservation. For example, many Indians feel that the dam is to blame for reductions in the commercial fish harvest, despite a lack of evidence to support this belief. These attitudes, along with the damages which formed them, could have been avoided only by major changes in the original project plans.

Project Operation and Maintenance:

5.04 Present operation of the reservoir permits continuing fluctuations of water levels in the Red Lake. The principal purposes of the operation of the reservoir are flood control and water supply. To meet these primary objectives, the adverse effects of both high and low water levels will unavoidably be felt. However, project operations are not completely indifferent to the water level problem. First of all, when a serious

water level problem is anticipated, operations are designed to mitigate the problem. Second, normal operating pool levels were chosen to reduce the impact of fluctuations to a minimum. Finally, the frequency of damaging high and low water levels will probably be reduced compared to the natural frequencies which prevailed before the project. Clearly, however, there is a certain amount of water level fluctuation that is unavoidable, unless the flood control and water supply objectives of the project are to be ignored; and even then, fluctuations would be significant.

6. ALTERNATIVES TO PRESENT PROJECT OPERATIONS

No Project Operation and Maintenance:

6.01 This alternative presumes that the control structures can be fixed in such a way as to approximate natural conditions before abandonment. This would avoid any immediate disaster resulting from overfilling or emptying the reservoir. The Corps would save about $29,000 per year based on an average of expenses in the past four years. However, flood control benefits of $67,500 or more would be lost. Moreover, the frequency of very high or low water levels would probably be increased. The prospect of eventual breakdown of the abandoned control structures due to non-maintenance would pose a threat of calamity to most residents in the Red Lake River subbasin.

Priority Regulation:

6.02 It would be possible to operate the reservoir giving priority to the maintenance of water levels most beneficial to the lake environment. This kind of operation would somewhat reduce the problems associated with abnormally high or low water levels. The flood control benefits presently derived from the project would consequently be lost, as would the potential benefits of emergency water supply. This loss would far exceed the comparatively slight advantage of priority regulation.

Raise Normal Operating Lake Levels:

6.03 It has been suggested that the outlet structure might be used to slightly raise the level of the reservoir above the 1174 foot elevation. The intent here would be to increase the production of northern pike in marsh areas. If the spawning areas in the adjacent marsh areas could be maintained at relatively high water levels northern pike population might be increased. On the other hand, one must ask whether the commercial value of the northern pike is sufficiently high to justify changing the water level. The northern pike usually constitutes less than 10 percent of the total harvest of all species and frequently less than 5 percent (Smith and Krefting, 1953). Thus, any slight increase in northern pike production would probably not have a significant economic impact and hence invalidate any large-scale water level manipulations for this purpose.

6.04 The effect of raising the lake level 1 to 2 feet would probably have little effect on the spawning beds of yellow perch or whitefish in the lake. At present, the level is raised from about 1174 to about 1174.5 feet in the spring (April or May) for flood control purposes. These manipulations appear to have little effect on walleye spawning since it takes place in rivers, or on the yellow perch or whitefish which spawn in the shallow water on the south and west shores of Lower Red Lake. However, because this topic appears to be of special concern, additional studies at the time of spawning using radio-tracking techniques could perhaps be used to provide the necessary information.

6.05 Increasing the normal pool elevation above the normal operating range of 1173.5 to 1174.5 feet is a possible alternative only if the potential effect of increased water level is studied to determine property damage that might result. Only limited development has taken place along the shore of the reservoir, but periodic high water levels are a problem for a limited number of individuals and resorts. It would thus affect the resort industry along Upper Red Lake and the private lakeshore property there.

6.06 During 1957, damage claims were filed by property owners on Upper Red Lake when the reservoir reached 1175.4 feet during early July. Since 1957 the lake has reached levels of 1175.5 to 1176 in 1962, 1966, 1969, and 1970. Thus, higher water levels have commonly occurred. No major increase in water level is presently recommended since property damage would occur and the holding capacity of the dam during periods of flood would be reduced.

6.07 If the operational level of the reservoir were increased from 1174 to 1175 feet, the surface area of the lake would increase from 288,880 to 291,500 acres. The increased surface area would cause an average yearly evaporation rate of 7.6 cfs or reduce the discharge from the reservoir by 1.9 percent. If an operational level of 1176 were considered the increased evaporation loss would reduce the average discharge by 3.4 percent. Deterioration of water quality by mineral salt buildup through concentration would not be expected under these conditions since the flushing time for the reservoir would not be appreciably increased.

6.08 From the standpoint of water quality, the operation of the reservoir at 1173.5 to 1174.5 feet is sound. Should a change to operating the reservoir at a higher water level be contemplated, extensive studies of the water quality of the low-lying bogs, their drainage water, and the water table should be conducted prior to any change in the current operating regime.

Lower Normal Operating Lake Levels:

6.09 Lowering the water level to 1173 or 1172 or below could have adverse effects on the spawning beds of lake-spawning yellow perch or whitefish.

The time of year at which these drawdowns would occur would be critical. For example, if the lake levels were dropped 2 feet while the ice was still present at thicknesses up to 30 inches, this could well scour the spawning beds. Similarly, if lake levels were dropped while the northern pike were still in the marsh areas adjacent to the outlet, these fish would be prohibited from entering the lakes.

6.10 If operation of water levels were required below 1174 feet in the summer, the Upper Lake could suffer adverse effects since its mean depth is 3.5 feet. Recreational boating could become a problem, especially in the shallow area near Waskish where most of the public use of the lake originates. The mean depth of the lower lake is 18 feet, but extensive areas of shallow water on the southern shore near the towns of Redby and Red Lake would cause navigation problems for the residents of those towns.

6.11 Water levels markedly below 1174 feet would reduce spawning areas for yellow perch and whitefish. Although the whitefish do not constitute a major portion of the catch, it is of some economic importance to the fisheries. The yellow perch is of primary importance in the food chain of the walleye. Reduced perch populations could cause reduced numbers or reduced growth of the walleyes of the reservoir.

6.12 Any decrease in operating levels would increase the storage capacity of the reservoir. However, in view of the potential damages which may result from such operation, this alternative does not appear to be economical. It would also probably violate the conditions established by the Red Lake Band of Chippewa Indians when they agreed to the use of their land and water for the original project (see exhibits 31, 32 and 33).

Lower Normal Operating Levels of Marshes:

6.13 Corps planners once proposed that the water levels in the regulated marshes be lowered in the fall and winter before refilling to maximum pool. It was later felt that this would dry out established muskrat houses, making the animals vulnerable to desiccation, starvation, and freezing temperatures. This would probably affect, also, the animals that prey on muskrats, conceivably leading to the reduction of entire animal populations. Fall drawdown of the marsh was considered as an aid to waterfowl feeding; however the potential harm to muskrats seems to outweigh this consideration. Any permanent reduction on marsh operating levels would be harmful to marsh ecology, and would tend to reverse the progress of the Corps restoration effort.

Embellishments:

6.14 Many ways have been suggested to aid in the understanding of problems and improvement of conditions in the project area. None of these suggestions actually calls for any fundamental change in present operation and maintenance procedures.

6.15 Suggestions to Improve Red Lake Fishery: The topic of most concern among the Red Lake Indians interviewed was the recent lack of success in their commercial fishing. Records show extreme fluctuations in catches in the past which have also caused great economic problems among the Indians. Their most frequent mention of a cause for this was that the fish are seen going down over the dam and never coming back up. Development of the Red Lake fishery would be the responsibility of the U.S. Fish and Wildlife Service.

6.16 Due to the inadequacies of the short-term limnological sampling program that was a part of this study and review of the literature relating to the commercial fisheries in the Red Lakes, it may be wise to pursue more complete data to learn enough to actually help the fishery to improve.

6.17 The water quality might be monitored over a period of 2 to 3 years to encompass any seasonal or annual changes that might occur. This would be of special importance in identifying the seasonal changes in phytoplankton and water discharges that enter the lake from the wild rice paddies. Such a long term study would permit one to check on the alleged increases in algal growth which occur during the summer and, according to several residents of the Reservation, have reached nuisance proportions during the summer. In future algal studies, a plankton net might be used to permit comparison with samples collected during the summer by Knapp (1960). Simultaneously, a grab-type plankton sampler could also be used to counteract the sampling errors inherent in the use of the net-type sampler.

6.18 It would likewise be highly desirable to include measurements of rates of biological productivity, by use of the chlorophyll method or the C^{14} technique. Such techniques would enable the investigators to obtain a more precise estimate of the trophic (nutritional) status of the lakes and the rates of photosynthesis that take place.

6.19 To investigate the outmigration of fish from Lower Red Lake, radio-tracking studies on the movement patterns of the commercially important species might also be included on the expanded project. Because spawning sites for walleye are of special concern, additional studies in the spring and at spawning time using radio-tracking techniques could perhaps be used to provide additional information on this point. The effect of winter drawdown of the lake level on fish spawn might be investigated. It has been suggested that the spawn may either freeze or be harmed mechanically by ice if the levels are low and the winter temperatures excessively low at the same time.

6.20 Tangible efforts such as structures for returning the fish or preventing their going over the dam are being investigated. A physical device, such as a channel or fish trap which would allow fish to return

to the lake may be necessary to alleviate this concern of tribal members. These efforts could be accompanied by information campaigns to tell the tribal members what has been done. This construction could be accompanied by an effort to explain the purposes of the mechanism and call attention to it. It is possible, during the time since the last fishway was built, that changes in design of fish ladders may have improved their success. This should be looked into, if this option is acted upon.

6.21 Suggestions to Restore Former Marsh Productivity: During interviews with the Red Lake Indians, the good results of the Corps' restoration of one-sixth of the Zah Gheeng Marsh were well-recognized, but many comments were also made that the marsh used to be still more productive. Further attempts could be made to restore the remainder of the marsh which was drained by the Corps channelization project on the Red Lake River. The regulation of Red Lake discharges into the marshes is controlled by the aforementioned extension agent, but final control of lake levels (hence marsh levels) rests with the reservoir regulating section of the St. Paul District Corps of Engineers.

6.22 A survey and plans drawn up by the United States Fish and Wildlife Service suggest strongly that 10,000 to 15,000 acres of presently dry marshes could be restored to a semblance of their original state by the erection of low dikes and use of outlet controls for the extensive drained marshes east and west of the large "off-take" drainage ditch extending northward from the Red Lake River at mile 175.5 to State Highway Number 1. By raising the level of the road along the ditch, building dikes along four presently drained areas (two on the east side of the road, two on the west side), and equipping the dikes with control gates, approximately 10,000 acres could be inundated under two feet of water. The areas involved are in townships 152 and 153N, ranges 37 and 38W. It is assumed that wildlife habitat would be significantly improved by such a project, and waters which enter this area from the north would be better controlled.

6.23 Much of this land could be restored as marsh, a small amount might be used for conventional farming, and portions of it might be successfully used for grazing, Christmas tree farming or lumber. Upland game habitat might also be developed.

6.24 Based on other data it appears that the muskrat is making a comeback and that as larger areas of the marsh are restored, tribal members will realize greater benefits from the dam and work on the Red Lake River.

6.25 In general, the Reservation residents interviewed would like to have their original marshland restored so that waterfowl and fur-bearers would increase in numbers, thus contributing to the tribe's income and food supply.

6.26 Long-term studies of vegetation and wildlife in the marsh could be made. There is a serious need for comprehensive studies on restored marsh and in order to assess the success of restoration projects. The role of aquatic mosses and other vegetation in water retention on extensive marshes should be carefully examined and considered as a possible means of water management in the Red Lake area.

6.27 The three resolutions passed by the Tribal Council in 1947, 1948, and 1949 (see exhibits 31, 32 and 33) leave little doubt that the Indians allowed the Red Lake Project construction in the Reservation only on the condition that most of the marshes would remain in their generally flooded condition. The restoration of approximately 20 percent of the original marshes has been remarkably successful. However, such massive natural trauma cannot be expected to mend within the interval of 6 or 7 years, and continued reevaluation and study of the affected areas is certainly indicated.

6.28 The four water-depth gages used in the Zah Gheeng Marshes do not correspond to each other or to the gages at the outlet dam. This makes calculations very cumbersome when the need for appropriate adjustments in the water level is being assessed. The adjustment of the gages is one possible action which could be taken that would help in present marsh management and would be relatively easy to correct.

6.29 A better form of keeping records of fur-bearers and waterfowl on the marsh might be devised. At present, it is extraordinarily difficult to assess the status of wildlife on the Red Lake Indian Reservation. Fluctuations in numbers of muskrats may or may not be meaningful, for record-keeping may not be accurate, the price of pelts or number of trappers varies from year to year, and even if other factors remain constant, it is known that muskrat populations fluctuate.

6.30 A land and game management plan might be established for the Reservation with the help of the Department of Natural Resources. The need for background information which would make it possible to establish a long-range plan for land use on the Reservation is great. The local District Conservationist suggests that as much as 50,000 to 60,000 acres on the Reservation could be used for growing wild rice. Some land could be used very satisfactorily for grazing. He believes that there should be a topographic survey of the whole area, done on a 1-foot contour interval, in order to select areas for rice, grazing, upland game habitat, waterfowl habitat, Christmas tree production, lumbering, and other uses. (Maps currently available have only 50-foot contour lines. Better mapping is in progress, but none on greater than a 10-foot contour is known of at this time.) Fires must be controlled before tree plantations near the dry marshes can be expected to be productive.

6.31 One of the most serious problems confronting the fur and game species of the terrestrial and marsh environment concerns the lack of ways to effectively enforce a game management plan. In the past, the abundance

of natural habitat, limited human population and access to marshes, and less efficient weapons and ammunition combined to create a situation in which year-round hunting pressure was no problem. Today, conditions are quite the opposite and there is a desperate need to protect waterfowl, large game, and other fur-bearers from hunting and trapping, largely during reproductive seasons.

6.32 The tremendous decrease in wilderness marshland, the relatively easy access made possible by motorized vehicles (including boats, snowmobiles, aircraft, and all-terrain vehicles), and more effective weapons all exert excessive pressure on animal populations. The creation of more wildlife habitat will not necessarily increase the number of animals unless significant changes are made in hunting and trapping practices. Several reports and interviews attested the fact that unwise practices placed burdens on waterfowl and other wildlife in excess of what the populations could bear.

6.33 An attempt could be made to increase understanding of ecology and, especially, game management. The Red Lake Indian Reservation contains a large segment of one of the most extensive marshlands in the United States; those persons who live closest to this remarkable habitat should have a broad understanding of its wildlife values and its vulnerability. A wisely and carefully undertaken educational program incorporating cultural values and conservation concepts could help in effecting some changes.

6.34 Suggestions to Maintain Present Good Water Quality in the Lakes: Although the small amount of data collected recently is too scanty to support firm conclusions, the Red Lakes water quality is probably good for its present uses. Several Indians, however, commented on the presence of floating dead fish, and algae on their fishing nets when asked whether they had noticed any changes in the quality of the Lake water since the dam was built. Efforts could be made to monitor it for changes which might adversely affect the fishery. A water quality monitoring program for all Corps of Engineers reservoirs in the St. Paul District is under consideration.

6.35 It is not wise to place a great deal of faith in comparisons of the 1932 to the 1962 or 1972 water quality data, since weather data, time of year, and approximate location of the 1932 samples are missing. If some assessment of change is to be made, a more extensive search of the literature could be undertaken to find more data, if they exist. Even the 1972 samples do not properly assess current water quality; sampling should be extended over a greater length of time and expanded to include the major streams entering the reservoir.

6.36 The development of pastureland for beef cattle and development of land for the wild rice industry have occurred during the past 10 years in the watershed. The potential for changes in water quality of the shallow

Red Lakes accompany these developments since an increase in nutrient load could result in increased production of algae. Admittedly, increased algae production may result in increased fish production, but the potential for this algae to reach nuisance proportions is quite high. The reservoir is one of the major walleye-producing lakes in a State known for walleye production. Monitoring of biological, physical, and chemical parameters could be initiated on the reservoir to detect any adverse changes that may be occurring with changes in land usage.

6.37 Because of the danger of adverse effects to the lake from harmful chemicals and possible high nutrient levels, wild rice paddies could be cultivated without pesticides and with a very conservative use of fertilizers. Although lower production of rice may result, the maintenance of a high quality of water for the fishery in the Red Lakes should more than compensate for this practice.

6.38 Another problem related to the water quality (and aesthetics) of the lakes is the occasional accumulation of floating debris on the upstream side of the dam. The presence of a small amount of debris would probably have little harmful effect on aquatic organisms by depressing the dissolved oxygen concentration, since it is maintained near saturation by the mixing effect of winds. It may, however, reduce water quality in other ways, and a few complaints have been made on its appearance. Perhaps the dam tender could be responsible for its removal as it accumulates.

6.39 Suggestions to Reduce Potential Damages: High water levels on the Red Lakes, in combination with wind, will produce a great deal of damage if development of the shoreline proceeds without planning and zoning. Flood protection of downstream farmlands and communities must not be obtained at the expense of upstream or lakeshore damage. Thus, greater thought should be given to flood-plain zoning on downstream floodplain lands. Other long-term solutions along the Red Lake River should also be sought. Zoning responsibilities would be on the Reservation organization.

6.40 Another alternative would be to study past weather and flooding data with respect to the presence of the Red Lake Dam. It is interesting to note that, of the eight major floods on the Red Lake River since 1880, one occurred in 1950 and five have occurred since that time (1962, 1965, 1966, 1967, and 1969). Surely this is no simple problem dependent upon only one or two variables: there are serious deficiencies in data regarding elevations, flow rates, and precipitation in precisely defined segments of the Red Lake River watershed. The question that may be approached with appropriate caution is whether the water-retaining potential of the vast moss-filled marshes adjacent to the Red Lake River was considered before the inception of the Red Lake Project; did the inadequacies of the Red Lake Project in fact contribute to the flooding potential of the Red Lake River rather than reduce it? More information may be needed on this subject.

7.0 THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Red Lake River and Zah Gheeng Marsh:

7.01 The propriety of the Corps of Engineers operation and maintenance activities in the Red Lakes area must be weighed against the potential damage incurred to any or all of man's life support system-the biosphere-thereby guarding against the short-sighted foreclosure of future options or needs. Past, present, and proposed actions and their associated impacts must be considered not only in relation to the specific lake plain affected but also to the greater area and public served by the project.

7.02 In pursuit of greater agricultural productivity this project was conceived and undertaken in 1948. Clearly, the natural resources of the Indian lands assigned to future agricultural development were undervalued. Both the Government and local leaders overestimated Indian interest in farming. The judgement that farming would better support the local population proved to be either faulty or, perhaps, premature.

7.03 In the case of the dried-up marshlands the logical question arises as to whether all or part of the land should be saved for future agricultural development, or should it, in response to the present needs and preferences of the local inhabitants, be restored. In making such a judgment the potential value of redevelopment must be assessed with due consideration to intangible values. The success of the Zah Gheeng Marsh Restoration Project indicates that eventually these damaged lands may be restored to full productivity, whether it be natural or agricultural.

Upper and Lower Red Lakes:

7.04 The principal use of both lakes is for flood control and water storage and the stabilization of the lake levels. To achieve this goal, the resulting fluctuations in water levels may influence other uses of the reservoir. At the present, we have the best fishery in terms of maximum sustained yields at the present water levels as regulated by the flood control structure. Any increases in water levels will probably have little effect on spawning beds or feeding areas, while decreases from the 1174-foot elevation would damage spawning areas in the spring. The fluctuations in the fishery appear to be the result of factors which influence the year class strength of the fish populations and also the interaction of populations of game and forage fish.

7.05 Any minor increase in levels of the reservoir should have little effect on the use of the lake for boating, but any marked drawdown would make the launching of boats difficult by extending the exposed shorelines. Similarly, drawdowns would also hinder boating in the shallower Upper Red Lake where there are extensive submerged sandbars which can catch the shafts of outboard motors.

7.06 When one considers the flat topography of the watershed and the multiple uses of the lakes for fish production and recreation, the initial construction of the structure was wise and the dam is presently maintained at about the only feasible level consistent with these multiple uses.

8. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH HAVE BEEN INVOLVED IN THIS ACTION SINCE IT WAS IMPLEMENTED

8.01 Use of and wear on equipment used in the construction can never be recovered, as well as building materials, labor, fuel, and the land on which the structures are located. The land thus committed to the main dikes totaled about 77 acres. Additional land totaling 12 acres was committed to construction of tieback dikes in the Zah Gheeng Marsh area, and disposal along its banks of material dredged from the Red Lake River.

8.02 As far as the marshes are concerned, it is possible that extensive restoration can be successfully undertaken. One way would be to restore the River to its original channel, as most of the Reservation residents interviewed would prefer, but if this is infeasible, the loss of its original meandering, slower velocity and larger fish would constitute an irreversible and irretrievable commitment of resources. The period of years which have passed since the 1948-1952 project have undoubtedly brought forth severely diminished wildlife species. However, much could be done to rectify this situation.

8.03 There appear to be no irreversible or irretrievable commitments of resources related to the commercial fisheries or to the production of wild rice which were involved in this action.

8.04 Because cultural resources in this area are so directly dependent upon natural resources, the reduction of wildlife has diminished local human resources, and will continue to do so until further marsh restoration has been accomplished.

9. COORDINATION

9.01 This document was drawn largely from a study by North Star Research and Development Institute, under contract with the Corps of Engineers. No organized public participation preceded its writing. However, extensive interviews were conducted with residents on the Red Lake Indian Reservation and others familiar with the area.

9.02 The reservoir and regulated marshes are operated by the Corps of Engineers in cooperation with the Bureau of Indian Affairs and the Fish and Wildlife Service, U.S. Department of the Interior.

9.03 The following agencies, interested groups and individuals were sent copies of the draft environmental impact statement for comments and review:

U.S. Environmental Protection Agency
U.S. Department of Agriculture
U.S. Department of Commerce
U.S. Department of Health, Education and Welfare
U.S. Department of Housing and Urban Development
U.S. Department of the Interior
U.S. Department of Transportation
Advisory Council on Historic Preservation
Upper Mississippi River Basin Commission
Upper Mississippi River Conservation Committee
Minnesota Department of Agriculture
Minnesota Department of Economic Development
Minnesota Department of Health
Minnesota Department of Natural Resources
Minnesota Department of Public Safety
Minnesota Environmental Quality Council
Minnesota Highway Department
Minnesota Historical Society
Minnesota Pollution Control Agency
Minnesota Resources Commission
Minnesota State Archeologist
Minnesota State Park Commission
Minnesota State Planning Agency
Minnesota Water Resources Board
Minnesota - Wisconsin Boundary Area Commission
Red Lake River Basin Planning Commission
Red Lake Watershed District
Red Lake Band of Chippewa Indians
Ducks Unlimited, St. Paul, Minnesota
Friends of the Earth, Minnesota Branch
Izaak Walton League, Minnesota Division
Minnesota Conservation Federation
Minnesota Environmental Control Citizens Association
Minnesota Pheasant Unlimited, Minneapolis, Minnesota
Minnesota Public Interest Research Group
National Audubon Society, North Midwest Regional Office
Northern Environmental Council
Sierra Club, North Star Chapter
Soil Conservation Society of America, Minnesota Chapter
Agriculture Research Center, University of Minnesota Technical College, Crookston
Minnesota Association of Conservation Education
Minnesota Environmental Education and Research Association
North Star Research amd Development Institute

Dr. Dale O. Anderson, Director, Water Resources Institute, North Dakota State University
Dr. H. Fuchsman, Director, Center for Environmental Studies, Bemidji State College
Dr. Richard Gray, Chairman, Fresh Water Biological Institure, University of Minnesota
Reverend William Gustafson, Litchfield, Minnesota
Mr. Charles Herman, Washkish, Minnesota
Dr. Edmund Hibbard, Tri-College University, Center for Environmental Studies, North Dakota State University
Mr. Floyd Jorgensen, University of Minnesota, Agriculture Extension Service
Dr. Daniel E. Willard, Institute for Environmental Studies, Madison, Wisconsin
Environmental Library of Minnesota, Minneapolis
Legislative Library, St. Paul

9.4 Comments on the draft statement were received from the following agencies and individuals:

U.S. ENVIRONMENTAL PROTECTION AGENCY

Comment 1: We have completed our review of the Draft Environmental Impact Statement (EIS) for Operation and Maintenance Activities at Upper and Lower Red Lakes, Minnesota. We have classified our comments as Category LO-2. Specifically, this means we have no major objections to the proposed action as described in the Draft EIS, but we believe more information should be provided to more fully assess the total project impact.

We believe that the Draft EIS effectively identified adverse impacts which have resulted from the original construction as well as the continued operation and maintenance of the Red Lakes project. Programs for restoration and investigation and monitoring of adverse effects were suggested in the EIS (pages 52 through 57), but no definite plans for assuming the responsibility therein was established. Therefore, further attention should be given to developing programs which would minimize the decline in environmental conditions which has occurred since the project was initiated. Specifically, plans for restoration of the remaining effected marshland, as well as for monitoring and mitigating adverse impacts on commercial fishing and trapping should be provided.

Response 1: An investigation into the feasibility of some form of mitigation of the adverse effects of the project is warranted. Monitoring of the fishery and trapping activities would be the responsibility of other agencies; however, the mitigative measures would be planned in coordination with all concerned.

Comment 2: It should be explained if existing water quality in the Upper and Lower Red Lakes is in compliance with applicable State standards.

Response 2: It has been classified by the Minnesota Pollution Control Agency. See paragraph 2.79.

Comment 3: Since any significant decrease in water levels could result in adverse effects on both lake and marsh ecology, future plans for regulation of lake and marsh levels should be explained. It was stated in the EIS that a 10-fold increase in the wild rice industry would be required before it would noticeably affect water level management of the reservoir. Considering the potential effects of algal growth due to high nutrient levels in rice-paddy discharges in relation to surface water resources, some prediction of future rice paddy development should be provided. We concur that local ricing development should be controlled and suggest that educational programs for fertilizer and pesticide use be conducted through the State or Department of Agriculture.

Response 3: The area agricultural extension agent states that a potential of 50,000 to 60,000 acres of wild rice paddies could be commercially developed on the reservation along the Red Lake and Clearwater rivers. This development would have no effect on the water quality of the Red Lakes, but it could affect downstream water quality. No estimate of upstream rice-growing potential could be obtained.

Comment 4: Finally, it should be stated in the Final EIS that while water storage for regulation of streamflow may be considered a potential beneficial effect of the project, such storage and water releases shall not be provided as a substitute for adequate treatment or other methods of controlling waste at the source.

Response 4: Concur. Although dilution of wastewater was included as a benefit of the original project, current State and Federal regulations indicate that it should not be provided as a substitute for adequate treatment or other methods of controlling wastes at their source.

U.S. DEPARTMENT OF AGRICULTURE

Comment 1: Paragraph 1.17. Fluctuating water levels by means of operating the marsh inlet and outlets would probably contribute to the total production of the marsh because of nutrient releases from exposed bottom soils.

Response 1: Concur. The paragraph has been revised.

Comment 2: Paragraph 2.73. The bald eagle and sandhill crane frequent the area and should be considered rare. It is also likely that the timber wolf (an endangered species) inhabits the area.

Response 2: The U.S. Fish and Wildlife Service recognizes two endangered species in the area; the eastern timber wolf and the arctic peregrine falcon. Operation and maintenance activities on the Red Lake project should have no effect on these species.

U. S. DEPARTMENT OF THE INTERIOR

Comments 1: 1.9 Reservoir: The Battle River flows into Lower Red Lake not Upper Red Lake as reported in the statement.

Response 1: The statement has been corrected.

Comment 2: 1.11 Marsh Outlets: We have been advised by Mr. Floyd W. Jorgensen, University of Minnesota Agricultural Extension Agent, that under normal conditions the north Zah Gheeng marsh area can be drained only back into Lower Red Lake. Also, no stop logs or fish barriers were ever provided.

Response 2: The problem of drainage back into the lake from the north marsh is being investigated. There are stop log recesses in the marsh outlet gates, but they have never been used. The only fish barriers on the marshes are at the inlets.

Comment 3: 1.18 Project Maintenance: This section needs further discussion. We suggest that the following information should be included:

1. The frequency of inspections and the officials responsible for them.

2. A description of the type of maintenance problems likely to occur and the methodologies for dealing with them.

3. A breakdown of the manhours and funds expended on the various types of maintenance activities annually.

Response 3: The information has been included in paragraphs 1.15-1.18 and exhibits 3 and 4.

Comment 4: 2.73 Rare and Endangered Species: We suggest that the status of the eastern timber wolf in the project area be discussed.

Response 4: See paragraph 2.64. The eastern timber wolf and the arctic peregrine falcon are two endangered species which inhabit the area.

Comment 5: 2.79 Historical and Archaeological: We suggest that further consultation be made with the State Historical Society to secure the opinion of Mr. Russell Fridley regarding the eligibility of any known properties in the Red Lake River Basin for nomination to the National Register of Historic Places and to obtain the recommendation of Dr. Elden Johnson regarding the need for archaeological surveys of lands that might be affected in the event that marsh restoration is undertaken in the future.

Further, any maintenance activities should be planned with a recognition of the possibility that undiscovered historical and archaeological resources may exist in the area.

Response 5: See paragraph 2.70 for a description of actions taken on historically significant items in the area.

DEPARTMENT OF THE INTERIOR (continued)

Comment 6: 4.26 Changes in Wild Rice Production: According to Mr. Jorgensen, only 15 pounds of rice were ever seeded in the marsh. This attempt would hardly prove conclusively whether or not wild rice would be successfully introduced.

Response 6: Concur.

Comment 7: 4.27 Effect of Rice Paddy Drainage on Lake Water Quality: There are no rice paddies in the Zah Gheeng marsh area.

Response 7: The statement has been deleted.

Comment 8: The entire Red Lake River has been designated by the Minnesota Department of Natural Resources (DNR) as a canoe and boating route pursuant to the Canoe and Boating Route Statute of 1967 (M.S.A. 85.22). The DNR plans to study the entire stretch of the river to determine its potential for inclusion in the Minnesota Wild and Scenic Rivers System. The draft environmental statement should discuss the impacts of channel maintenance activities on those wild and scenic river values and, where applicable, discuss measures to be taken to eliminate or lessen any adverse impacts from such activities.

Response 8: If the Red Lake River were designated as a wild and scenic river, maintenance activities within our jurisdiction would be coordinated with all agencies concerned to implement the most environmentally compatible plan.

Comment 9: Although the statement indicates that channel maintenance outside the Red Lake Indian Reservation is the responsibility of the local sponsors of the project and that to date no channel maintenance has been required outside the Reservation, the probable impact of future channel maintenance activities should be discussed. In this regard, the effect of channel maintenance activities on recreational areas and sites, including three recreation and boat access sites located at High Landing Bridge area, River Valley Bridge area, and the Neptune Crossing of State Route 27, should be assessed and the impacts determined and included in the final statement. This effort should be carried out in cooperation with the local interest responsible for the channel maintenance activities and the Pennington County Board of Commissioners. Where necessary, mitigating measures whould be developed to offset any adverse effects on those recreation and boat access sites.

Response 9: The assessment of potential impacts of channel maintenance activities on recreation areas is important, however, the responsibility for these activities rests with the local sponsors of the project. Therefore, your concerns should be directed to the local sponsors concerned. However, the Corps of Engineers does inspect the project to insure compliance with operation and maintenance agreements. When these inspections are performed every effort will be made to insure that these activities are compatible with established environmental guidelines.

DEPARTMENT OF THE INTERIOR (continued)

Comment 10: This section (section 7) should consider the long-term biological productivity of the area as it has been affected by the project and its maintenance. A discussion of possible consequences to fish and wildlife resources and endangered species should be included.

Response 10: The effect of the project on biological productivity and fish and wildlife is discussed extensively in other sections of the impact statement.

Comment 11: 7.5 Lower Red Lake and that portion of Upper Red Lake within the reservation boundaries do not support pleasure boating and sport fishing as these activities are restricted by the Red Lake Tribal Council.

Response 11: The sentence has been deleted.

Comment 12: The map on the cover page does not accurately depict the northeast boundary of the reservation.

Response 12: The border has been revised to reflect this. The cover map has been deleted.

Comment 1: Perhaps the statement which best expresses our concern appears on page 41, paragraph 4.32: "There can be no doubt that the channelization of the Red Lake River resulted in the desiccation of thousands of acres of marsh which (previously) were predominantly excellent wildlife habitat." The draft EIS estimates the acreage affected at from 50,000 to 60,000 acres.

Response 1: We recognize that the project has had adverse effects on wildlife, particularly migratory waterfowl, but the responsibility for drainage of the marshland does not rest solely with the channelization project. Perhaps 50 percent of the drainage-affected marshland was the result of early efforts by the State of Minnesota and other concerns to reclaim the land for agricultural use. From 1908, with the enactment of the Volstead Act, to 1916 large-scale construction of drainage ditches occurred. Completion of the Corps of Engineers channelization project in 1956, the scope of which was reduced to save some of the remaining marshland (see para. 1.05) added to the marsh drainage problem. In 1967, the marsh restoration project which eventually restored approximately 3,300 acres to the Zah Gheeng Marsh was completed. This stage of restoration is still not operating to its expected capabilities, since the north marsh is draining back into Lower Red Lake rather than the desired opposite action. The matter is being investigated.

Comment 2: Attempts to restore the marshes have largely failed, with the exception of the Zah Gheeng and Ki-Wo-Say marshes, totalling some 10,000 acres Some additional information not given in the draft EIS documenting these failures is given on page 88. However, the statement on p.45, paragraph 4.44 sums it up: " Examination of the control structure (weir) at mile 178.8 on the Red Lake River... raises questions as to the purpose of the weir...it does not contribute significantly to restoration of marshes north and south of the river bed."

Response 2: The purpose of the weir at mile 178.8 was to raise the river level to approximately what it would have been without channel improvement, thereby reducing drainage from the marshes and improving conditions within them. This benefit was not realized to any measurable extent so additional marsh restoration was undertaken in 1965 with the resultant restoration of about 3,300 acres.

Comment 3: The project has greatly damaged the resources of the area, especially tens of thousands of acres of marsh, as well as the fishery in the river. This in turn has very seriously affected the Indians of the Red Lake Band who relied on the natural systems for hunting, trapping and fishing as a livelihood.

Response 3: Recognizing that the project has had adverse effects on the marshlands of the area, an investigation is proposed to study possible mitigative measures.

Comments 4: The project is not accomplishing very well the purposes for which it was established, namely flood damage reduction and stream-flow augmentation. Only five percent of the stream-flow at Crookston is contributed by Red Lakes, and most of the inability of the Red Lake River to adequately handle peak flows is due to ditches entering the river downstream from the project.

Response 4: The project has accomplished flood damage reduction in the area adjacent to the improved channels since it controls 85 percent of the drainage area above the dam. It also provides an outlet for subsequent long-needed tributary drainage improvements. It was not designed or intended to reduce flows at Crookston. The project also supplies a sustained, channelized flow of relatively clear water in contrast to the stagnant marsh water outflow of pre-project conditions.

Comment 5: To accomplish the stated purposes of the project, lake levels would have to fluctuate more than the one foot or so which apparently is all that is presently feasible, given considerations to land uses around the lakes.

Response 5: The project is accomplishing the stated purposes within the operation plan as described. Under "normal" conditions the lake will have an annual fluctuation of 1 foot. During extreme conditions the lake has a potential range of over 6 feet. This would probably not occur in any one year and would depend partly on whether the project were being used solely for flood control or for low flow augmentation.

Comment 6: The natural level of the Red Lakes before the first manipulation is not stated.

Response 6: A Corps of Engineers rating curve which describes conditions prior to impoundment showed the lake elevation at normal flow (400 cfs) to be about 1172.5. It would vary approximately 1 foot during high or low flows with extremes of about 2 feet either way.

Comment 7: The Red Lake basin has considerably more wild rice paddy area than the 5000 acres mentioned in paragraph 2.81, page 26. Permits have been issued for more than 11,000 acres on the Clearwater River alone, and permits on another 7000 acres are pending.

Response 7: The sentence refers only to upper Beltrami County not the whole Red Lake basin. The intent of this section was to show that the wild rice operations could be greatly expanded without severely affecting reservoir levels.

Comment 8: The statement on page 35, paragraph 3.5 that "all the land that can be economically used for agriculture is so used" is not entirely true. A recent DNR study shows that 54,000 acres along the Clearwater River could economically be developed for wild rice production.

Response 8: The statement has been deleted.

DEPARTMENT OF NATURAL RESOURCES (continued)

Comment 9: To avoid confusion, the reference to the Minnesota Forest Service on page 31, paragraph 2.105 should read Minnesota Department of Natural Resources.

Response 9: The statement has been corrected. (See paragraph 2.92 Final EIS).

Comment 10: In the limnological data presented, the secchi disc readings were quite low and the nitrogen and phosphorous values were quite high, so a limnological water sampling program should be initiated to ascertain how representative those findings are. Summer values could be quite different, and they might vary considerably in various parts of the lake.

Response 10: The Corps of Engineers, St. Paul District may implement a water quality sampling program at the reservoirs within the District, but the future of that program is unsure at this time.

Comment 11: Again, we feel strongly that the losses that have occurred as a result of this project should be rectified, and that such action should supercede present project operating objectives.

Response 11: The loss of the marshland and its subsequent effects on all concerns will be investigated.

STATE OF MINNESOTA - POLLUTION CONTROL AGENCY (letter dated February 18, 1975)

Comment 1: Streamflow augmentation benefits have not been determined for the projects cost/benefit analysis.

Response 1: Streamflow augmentation benefits were incorporated in the economic analysis of the project. They are detailed in the original project plan for flood control for Red Lake and Clearwater Rivers titled "Red Lake River and Tributaries, Including Clearwater River, Minnesota" in House Document No. 345, 78th Congress, 1st session.

Comment 2: Augmentation for waste dilution purposes does not conform with present state policy.

Response 2: Concur. The original project plan was prepared in 1943. At that time wastewater dilution was a viable benefit of the project.

Comment 3: There is no documentation of the "harassing floods" or extent of their damages in the draft EIS.

Response 3: See revised paragraph 1.04.

Comment 4: According to the draft EIS the drawdown starting date is based on a request by the U.S. Fish and Wildlife Service for stabilized water levels downstream from the dam, and for water supply requirements for sugar beet processing. The hydrological data upon which this request is based should be included in the EIS.

Response 4: Conceivably, drawdown of the reservoir could be delayed until much later than 15 September as long as a level of 1173.5 was reached by 1 April. The longer the starting date is delayed, the greater the amount of water released in a short period of time. The Fish and Wildlife Service desires a more stabilized flow over a longer period of time to avoid the disruption of waterfowl and furbearers. The sugar beet processing industry requires increased flows in the fall of the year. Although the amount of water discharged in recent years has been much greater than that required for downstream use, the guidelines have been set to assure a minimum flow in times of need. The amount of water discharged over the drawdown period is controlled by the reservoir level. If the reservoir were low, the drawdown discharge would be low, but it would still be greater than the "normal" flow (this benefits the sugar beet industry). In summary, the date for starting drawdown is set, but the amount of water discharged is not always the same from year to year.

Comment 5: Biological and chemical analysis of water in the reservoir do not provide sufficient data to support statements on water quality.

Response 5: Comment noted.

Comment 6: Statements on reservoir productivity cannot be supported as no productivity studies (planktonic or benthic) were done. In light of the decline in the fishery industry at the reservoir it is important that the productivity of the planktonic and benthic communities be determined.

Response 6: See sections 2.81 through 2.86 and exhibits 26 and 27.

Comment 7: Taxonomic work on the benthic community is inadequate as many of the organisms can be determined to at least the genus if not species level.

Response 7: We feel that the water sampling program could have been better, but considering several overriding circumstances, such as time and money available, the unpolluted nature of the lake, and the absence of anticipated major changes in project operation, the taxonomic work was adequate. A water testing program for the Corps of Engineers, St. Paul District reservoirs may be started in the near future. At that time it may be practical to review the trends in the water quality of the Red Lakes with greater detail. The lack of data on preproject conditions prohibits that action at the present time.

Comment 8: In summary, a complete cost/benefit study should be prepared to determine if it is advisable to continue operation and maintenance activities as they have been done in the past, or if a new strategy is needed in this area. This cost/benefit analysis should be based on a much more extensive environmental monitoring program as existing data on reservoir water quality, productivity, and biological diversity are too insufficient to be of any value. Particular emphasis should be placed on possible water quality effects from the production of wild rice, marsh restoration, and fluctuation of water levels in the reservoir.

Response 8: The economic analysis of the Red Lake and Clearwater River Project was prepared in 1943, giving a benefit/cost ratio of 1.87. The project was authorized by the Flood Control Act of 12 December 1944 (P.L. 78-534) in accordance with House Document No. 345, 78th Congress, 1st session. The purpose of the impact statement is to evaluate the effects of operation and maintenance activities not to reanalyze the economic feasibility of the project which Congress has authorized. To do so would require specific direction by Congress.

STATE OF MINNESOTA - POLLUTION CONTROL AGENCY (Letter dated February 21, 1975)

Comment 1: The Draft EIS states, on page A-5, that during drought conditions the reservoir release rates will be cut to a maximum of 15 cfs, but never lower than 5 cfs. The Draft EIS should go further to explain what the low flow would be under all the alternatives, especially the alternatives of "No project operation and maintenance," and lower normal operating lake levels.

Response 1: Under the alternatives of higher or lower than present reservoir levels (1173.5) the outflow conditions remain essentially the same. That is, a minimum outflow of 5 cfs is assured. The difference lies in the fact that with a lower pool the chance of reaching the minimum outflow is increased because there is less stored water, whereas, with the higher pool, the safety margin is increased.

The alternative of "no project operation and maintenance", essentially a return to approximate preproject or natural conditions would eliminate the assurance of a minimum flow. In the 1930's the Red Lake River ceased flowing three times. Drought would be the low flow condition under the "no project" alternative. If the reservoir level of 1170.5 were reached, as it was in the drought years, the dam would still provide 5 cfs and perhaps up to 60 cfs discharge flow depending on inflow conditions.

Comment 2: In addition to presenting low flows for all alternatives, we feel that there should be an assessment of the impact on low flows in the Thief River Falls area of the Red Lake River. Thief River Falls is the first community downstream from the reservoir which relies on the Red Lake River for drinking water supply and wastewater dilution.

Response 2: Thief River Falls is assured a 5 cfs flow from the Red Lake River under present operating conditions during low flow discharge. These levels of flows would provide a reliable and adequate water supply for Thief River Falls. Without the project, the chance of zero flow or drought conditions in the Red Lake River exists.

Waste treatment by dilution of wastewater is no longer consistent with state policy. Although this was originally included as a project benefit it cannot be so considered today.

UNIVERSITY OF MINNESOTA - AGRICULTURAL EXTENSION SERVICE

Comment 1: The Cover: The boundary crossing upper Red Lake is not a curved line but rather by treaty reads from a given point on the south shore due north to given point on north shore, follow the shore line westerly to given point and then due west. This misprinted map has caused severe damage in area relations and needs to be corrected.

Response 1: Appropriate corrections have been made to exhibit 7 and the cover map has been deleted.

Comment 2: 1.4 - The sentence, overflowed or marshy lands ceded by the Chippewa Indians to the State of Minnesota. In checking with several Indian leaders they maintain no land was ceded to the State of Minnesota. Their statements maintain the land was ceded to the United States Government.

Response 2: In 1908, under the Volstead Act, the land was ceded to the State of Minnesota for construction of the drainage ditches. In 1958 the land reverted to the Indians when the State didn't fulfill the terms of the original agreement.

Comment 3: 1.9 - The Battle River does not flow into upper Red Lake. It flows into lower Red Lake.

Response 3: The statement has been corrected.

Comment 4: 1.10 - The north unit of the marsh will not fill from the inlet unit from the lake, but rather on numerous occasions rather discharges into the lake. During periods of low lake levels, it is impossible to flood the north unit.

Response 4: The water from the lake to the marsh should indeed be flowing into the marsh. Paragraph 1.10 has been revised to reflect this information and the situation is being investigated for possible solutions.

Comment 5: 1.11 - The last sentence indicates that there are stop logs and fish barriers at the outlet structure. There has never been either logs or barriers since the construction of the area. There should be for this type of an operation.

Response 5: The sentence has been deleted from the statement. There are stop log recesses in the outlet gate but they have never been used. The only fish barriers on the marshes are at the inlet structure.

Comment 6: 1.12 - Indicates a freeboard of two feet on the levees but actually this figure is much less. Either the levees are not up to grade or the gauges are not accurate.

Response 6: Some settling of the dikes may have occured since their construction. The matter is being investigated.

AGRICULTURAL EXTENSION SERVICE (continued)

Comment 7: 1.17 - The operator does not rely on his own judgement but rather consults with the Tribal officers and the U.S.F.W.

Response 7: The statement has been corrected.

Comment 8: 2.73 - There are both bald eagles and timber wolves and a complete study is needed to determine an accurate amount.

Response 8: The northern bald eagle is not recognized as a threatened or endangered species. The eastern timber wolf and the artic peregrine falcon (during its migration) are both endangered inhabitants of the area. The paragraph has been changed to reflect this and appears as paragraph 2.64 in the final EIS.

Comment 9: 2.74 - In checking the records one will find that prior to World War 1, the Chippewa Indians did supply their own agricultural foods and in fact prevented other Indians from starvation by supplying grain and vegetables.

Response 9: The paragraph has been revised to reflect this information (final EIS paragraph 2.68).

Comment 10: 2.79 - There are Indian burial ground on the west end of lower Red Lake that should be preserved. These are of a mound type and are historically important. Also, on the east end of lower Red Lake, there are numerous large sand dunes that should be preserved.

Response 10: The Corps of Engineers has been notified by the State Archaeologist of the existence of the burial ground. The significance of the sand dunes has not been determined at this time. This information is reflected in paragraph 2.70, final EIS.

Comment 11: 1.48 - The Tribal Officers have requested a fish ladder of proper design to do the job. They feel that there was direct neglect in past trial efforts. It is a common feeling that the ladder was not designed for fresh water fish.

Response 11: Fish ladders are generally designed for salmonids such as salmon and trout. Walleyes and northern pike, the prevalent species in the Red lakes do not tend to use fish ladders. An investigation into the possibility of providing some means of fish transport back into the lake is being conducted by the United States Fish and Wildlife Service at Bemidji, but the practicality of such measures is questionable.

Comment 12: 4.26 - There has been no real attempt to introduce wild rice to the area. Up until this time there has never been funds for such an effort. There is a need to establish wild rice to enhance the waterfowl utilization of the area.

Response 12: The intent of the paragraph was to stress the fact that although the channelization project reduced the potential rice-growing area, the existing rice paddies were not affected. The need to establish wild rice has not been investigated by the Corps of Engineers.

AGRICULTURAL EXTENSION SERVICE (continued)

Comment 13: 4.27 - It is difficult to study the effects of drainage water of the Zah Gheeng wild rice paddies when there are none in existence.

Response 13: The statement has been deleted.

Comment 14: 7.5 - The portion of upper and all of the lower Red Lake that are within the reservation boundaries are not open to pleasure boating and sport fishing. This area is reserved for commercial fishing.

Response 14: The paragraph has been corrected.

Comment 15: Exhibit 7 A - 9 This map does not indicate the proper boundary of the upper lake.

Response 15: The map has been corrected to show the proper reservation boundary across Upper Red Lake.

Comment 16: Exhibit 9 A - 11 It is unfortunate that representation from the society did not consult the tribe regarding the burial mounds.

Response 16: The Minnesota State Archaeologist has contacted the Corps of Engineers concerning the existence of the archaeological site at the source of the Red Lake River. His letters are shown in Exhibits 9a and 9b.

H. PAUL FRIESEMA

Comment 1: I suppose the basic problem with this EIS is that it appears to propose more of the same, while it should be concerned with analyzing the environmental impacts of fully restoring the Indian's land and water to a pre-project status. More specifically, you indicate (page 35) "The Tribal Council, under Chairman Roger Jourdain, governs the reservation and has authority over land use on the Reservation. The Council's development plans are for (in order of priority) fisheries, ricing and marsh restoration... Considerable capital expenditures are needed for development, and no funds are immediately available for that purpose...

Since you acknowledge that the drying out of the marshes, the reduction in potential and actual ricing areas, and the loss of fishing potential have all been unintended consequences of the Corps project which was intended to benefit others, but not even intended to be for the benefit of the Indians, it seems to me that the Corps of Engineers should be the "concerned agency desiring to implement a restoration plan." If you have no specific statutory authority, or discretionary funding, then General Morris should seek such funding from the Congress.

Response 1: An investigation into the feasibility of some form of mitigation of the adverse effects of the project is warranted. You can be assured that the Corps of Engineers is a concerned agency and that any plan of action will be thoroughly coordinated with the development plans of the Tribal Council.

Comment 2: When you consider alternatives to the present project operations, you do not explicitly consider the alternatives of engaging in whatever work is necessary to restore this area to its pre-project state. You consider abandonment, of course, just briefly. You do state (p. 49), about abandonment "The Corps would save about $29,000 per year based on an average of expenses in the last four years. However, flood control benefits of $67,000 or more would be lost." But the proper figures to examine would include, for costs, those benefits foregone, by maintenance of this project. Only assessing those items for which a monetary value can be assigned, I am confident that you could find up to the hundreds of thousand dollars foregone involuntarily by the tribe, because of the maintenance of this project (commercial and family ricing, fishing, hunting, trapping, guiding and tourist/hunting services, etc. and subsistence activities.) That is what ought to be weighed against the flood control, etc., benefits.

Response 2: The benefits to be derived from the original project were flood control, streamflow augmentation for water supply, and pollution abatement by wastewater dilution. Since the additional drainage of marshland was unforeseen, the "benefits foregone" by maintenance of the project were not

weighed against the aforementioned benefits derived from project implementation.

Any study conducted on the feasibility of mitigative measures would take into account the "foregone benefits" and they would help form the basis for justification of any action taken.

Comment 3: As I review the project benefits claimed for this project, they all seem to be benefits for whites, while all the (very heavy) bad consequences affect the Indians.

(a) Is that statement true, or nearly true.
(b) If so, aren't you bound by at least a compelling moral obligation to rectify this situation?

Response 3: Rather than a moral obligation, the Corps of Engineers and all Federal agencies have a legal obligation to assess the impact of any project significantly affecting the quality of the human environment. The Chippewa Indians on the Red Lake Reservation are very much a part of the human environment in both lifestyle and livelihood.

All Corps projects are evaluated with respect to their contribution to the national economic efficiency. This means that all citizens are affected indirectly by the project.

The more immediate effect of marshland drainage, influenced by the river channelization, was unforeseen at the inception of the project. This is evident because the Indians themselves approved of the original project (see exhibit 31). This is something they and the Corps certainly would not have done had they known what was to happen.

The loss of the marshland and its subsequent effects on all concerns will be investigated.

LETTERS OF COMMENT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN STREET
CHICAGO, ILLINOIS 60604

Colonel Max W. Noah
District Engineer
U. S. Army Engineer District, St. Paul
1210 U. S. Post Office & Customhouse
St. Paul, Minnesota 55101

FEB 27 1975

Dear Colonel Noah:

As requested in your letter dated December 27, 1974, we have completed our review of the Draft Environmental Impact Statement (EIS) for Operation and Maintenance Activities at Upper and Lower Red Lakes, Minnesota. We have classified our comments as Category LO-2. Specifically, this means we have no major objections to the proposed action as described in the Draft EIS, but we believe more information should be provided to more fully assess the total project impact. In accordance with our responsibility under Section 309 of the Clean Air Act, the classification and date of our comments will be published in the Federal Register. We submit the following comments.

We believe that the Draft EIS effectively identified adverse impacts which have resulted from the original construction as well as the continued operation and maintenance of the Red Lakes project. Programs for restoration and investigation and monitoring of adverse effects were suggested in the EIS (pages 52 thru 57), but no definite plans for assuming the responsibility therein was established. Therefore, further attention should be given to developing programs which would minimize the decline in environmental conditions which has occured since the project was initiated. Specifically, plans for restoration of the remaining effected marshland as well as for monitoring and mitigating adverse impacts on commercial fishing and trapping should be provided.

It should be explained if existing water quality in the Upper and Lower Red Lakes is in compliance with applicable State standards.

Since any significant decrease in water levels could result in adverse effects on both lake and marsh ecology, future plans for regulation of lake and marsh levels should be explained. It was stated in the EIS that a 10-fold increase in the wild rice industry would be required

before it would noticeably affect water level management of the reservoir. Considering the potential effects of algal growth due to high nutrient levels in rice-paddy discharges (especially in the soft water found in the Red Lakes) and of over-use in relation to surface water resources, some prediction of future rice paddy development should be provided. We concur that local ricing development should be controlled and suggest that educational programs for fertilizer and pesticide use be conducted through the State or Department of Agriculture.

Finally, it should be stated in the EIS that while water storage for regulation of streamflow may be considered a potential beneficial effect of the project, such storage and water releases shall not be provided as a substitute for adequate treatment or other methods of controlling waste at the source.

We appreciate the opportunity to review this Draft EIS. Please send us two copies of the Final EIS when it is filed with the Council on Environmental Quality.

Sincerely yours,

Donald A. Wallgren
Chief,
Federal Activities Branch

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Eastern Region
633 West Wisconsin Avenue, Milwaukee, WI 53203

8420

March 3, 1975

District Engineer
St. Paul District, Corps of Engineers
1210 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Gentlemen:

We have reviewed the draft Environmental Statement for the Upper and Lower Red Lakes Operation and Maintenance Activities. There is little to comment on in that most substantial "environmental impacts" have occurred years ago.

We recommend, however, that the following changes be made.

1. Paragraph 1.17. Fluctuating water levels by means of operating the marsh inlet and outlets would probably contribute to the total production of the marsh because of nutrient releases from exposed bottom soils.

2. Paragraph 2.73. The bald eagle and sandhill crane frequent the area and should be considered rare. It is also likely that the timber wolf (an endangered species) inhabits the area.

Thank you for the opportunity to review this statement. We look forward to receiving a copy of the final statement.

Sincerely,

JAY H. CRAVENS
Regional Forester

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
REGION V
300 SOUTH WACKER DRIVE
CHICAGO, ILLINOIS 60606

OFFICE OF
THE REGIONAL DIRECTOR

January 20, 1975

Mr. Max W. Noah
Colonel, Corps of Engineers
District Engineers
Department of the Army
1210 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Mr. Noah:

RE: Draft Environmental Impact Statement
Red Lake and Clearwater River
Maintenance and Operation
Red Lake River Basin, Minnesota

We have reviewed the Draft Environmental Impact Statement for the above project. To our knowledge, and based upon the information provided, this project will not impact to any significant degree on the health, education or welfare of the population.

Sincerely yours,

Robert A. Ford

Robert A. Ford
Regional Environmental Officer

cc Charles Custard, OEA
Warren Muir, CEQ

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
MINNEAPOLIS-ST. PAUL AREA OFFICE
GRIGGS-MIDWAY BUILDING, 1821 UNIVERSITY AVENUE
ST. PAUL, MINNESOTA 55104

REGION V.
300 South Wacker Drive
Chicago, Illinois 60606

IN REPLY REFER TO:

5.6ECO:RH

FEB 6 1975

Max W. Noah
Corps of Engineers
District Engineer
1210 U.S. Post Office & Custom House
St. Paul, MN 55101

Dear Mr. Noah:

Subject: Draft Environmental Impact Statement
Operation and Maintenance
Red Lake and Clearwater Rivers Project

Upon reviewing the draft EIS, we find that, within the jurisdiction by law on special expertise of the Department of Housing and Urban Development, no negative comments are required. The subject project appears unusually necessary and worthwhile, particularly in view of the need for effective use of flood control and low-flow augmentation system for the Red Lake and Clearwater Rivers area.

Sincerely,

Madeline Hastings

FOR Thomas T. Feeney
Area Director

United States Department of the Interior

OFFICE OF THE SECRETARY
NORTH CENTRAL REGION
230 S. DEARBORN STREET, 32nd FLOOR
CHICAGO, ILLINOIS 60604

(ER-75/6)

February 14, 1975

Colonel Max W. Noah
District Engineer
U.S. Army Engineer District
St. Paul
1210 U.S. Post Office & Custom House
St. Paul, MN 55101

Dear Colonel Noah:

The Department of the Interior has reviewed the Draft Environmental Statement for the Upper and Lower Red Lakes Operations and Maintenance Activities, Red Lake River Basin, Minnesota, as requested in your transmittal letter of December 27, 1974, to our Assistant Secretary, Program Policy. Our comments relate to areas of our jurisdiction and expertise and have been prepared in accordance with the National Environmental Policy Act of 1969.

1. PROJECT DESCRIPTION

Structures

1.9 Reservoir: The Battle River flows into Lower Red Lake not Upper Red Lake as reported in the statement.

1.11 Marsh Outlets: We have been advised by Mr. Floyd W. Jorgensen, University of Minnesota Agricultural Extension Agent, that under normal conditions the north Zah Gheeng marsh area can be drained only back into Lower Red Lake. Also, no stop logs or fish barriers were ever provided.

Operation Procedures

1.18 Project Maintenance: This section needs further discussion. We suggest that the following information should be included:

1. The frequency of inspections and the officials responsible for them.

2. A description of the type of maintenance problems likely to occur and the methodologies for dealing with them.

3. A breakdown of the manhours and funds expended on the various types of maintenance activities annually.

2. ENVIRONMENTAL SETTING

Present Conditions of Project Land and Water

2.73 Rare and Endangered Species: We suggest that the status of the eastern timber wolf in the project area be discussed.

2.79 Historical and Archaeological: We suggest that further consultation be made with the State Historical Society to secure the opinion of Mr. Russell Fridley regarding the eligibility of any known properties in the Red Lake River Basin for nomination to the National Register of Historic Places and to obtain the recommendation of Dr. Elden Johnson regarding the need for archaeological surveys of lands that might be affected in the event that marsh restoration is undertaken in the future.

Further, any maintenance activities should be planned with a recognition of the possibility that undiscovered historical and archaeological resources may exist in the area.

4. THE ENVIRONMENTAL IMPACT OF THE PROJECT

Impact of the Project on Water Quality and Water Levels

4.26 Changes in Wild Rice Production: According to Mr. Jorgensen, only 15 pounds of rice were ever seeded in the marsh. This attempt would hardly prove conclusively whether or not wild rice would be successfully introduced.

4.27 Effect of Rice Paddy Drainage on Lake Water Quality: There are no rice paddies in the Zah Gheeng marsh area.

Impact of the Project on Recreation

The entire Red Lake River has been designated by the Minnesota Department of Natural Resources (DNR) as a canoe and boating route pursuant to the Canoe and Boating Route Statute of 1967 (M.S.A. 85.22). The DNR plans to study the entire stretch of the river to determine its potential for inclusion in the Minnesota Wild and Scenic Rivers System. The draft environmental statement should discuss the impacts of channel maintenance activities on those wild and scenic river values and, where applicable, discuss measures to be taken to eliminate or lessen any adverse impacts from such activities.

Although the statement indicates that channel maintenance outside the Red Lake Indian Reservation is the responsibility of the local sponsors of the project and that to date no channel maintenance has been required outside the Reservation, the probable impact of future channel maintenance activities should be discussed. In this regard, the effect of channel maintenance activities on recreational areas and sites, including three recreation and boat access sites located at High Landing Bridge area, River Valley Bridge area, and the Neptune Crossing of State Route 27, should be assessed and the impacts determined and included in the final statement. This effort should be carried out in cooperation with the local interest responsible for the channel maintenance activities and the Pennington County Board of Commissioners. Where necessary, mitigating measures should be developed to offset any adverse effects on those recreation and boat access sites.

7. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

This section should consider the long-term biological productivity of the area as it has been affected by the project and its maintenance. A discussion of possible consequences to fish and wildlife resources and endangered species should be included.

Upper and Lower Red Lakes:

7.5 Lower Red Lake and that portion of Upper Red Lake within the reservation boundaries do not support pleasure boating and sport fishing as these activities are restricted by the Red Lake Tribal Council.

The map on the cover page does not accurately depict the northeast boundary of the reservation.

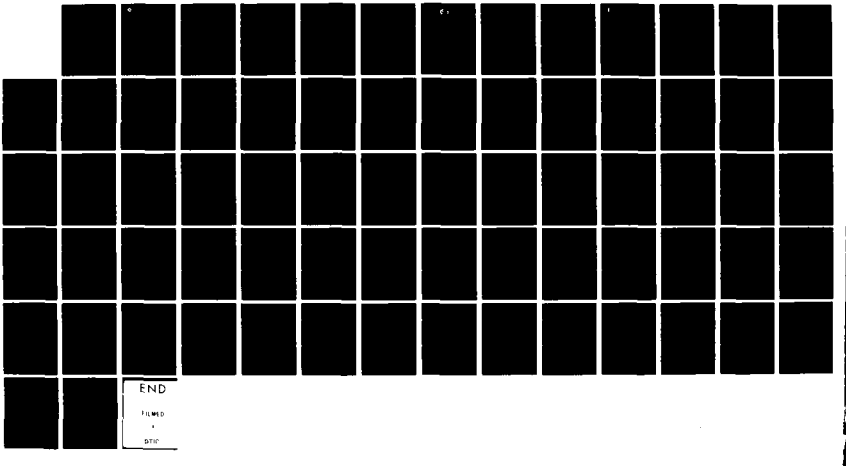
Sincerely yours,

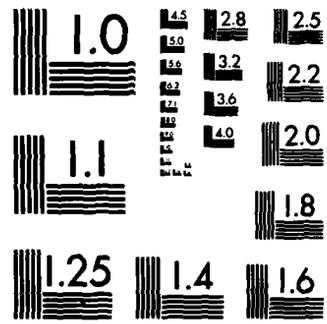
Madonna F. McGrath

Madonna F. McGrath
Acting Special Assistant
to the Secretary

AD-A121 522 FINAL ENVIRONMENTAL IMPACT STATEMENT UPPER AND LOWER RED LAKES OPERATION A. (U) CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT MAR 75 2/2

UNCLASSIFIED F/G 13/2 NL





U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION 5
18209 DIXIE HIGHWAY
HOMEWOOD, ILLINOIS 60430

January 27, 1975

IN REPLY REFER TO
05-00.5

Colonel Max W. Noah
District Engineer
St. Paul District, Corps of Engineers
1210 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Colonel Noah:

As requested in your December 27, 1974, letter, we have reviewed the draft environmental statement for operation and maintenance, Red Lake and Clearwater Rivers Project, Minnesota.

The proposed action does not appear to have any environmental effect on existing or proposed highways or highway users. We, therefore, have no comments to offer on the proposed action.

The opportunity to review and comment on the draft environmental statement is appreciated.

Sincerely yours,

H. L. Anderson
Regional Administrator

By:

W. G. Emrich, Director
Office of Environment and Design

STATE OF MINNESOTA
DEPARTMENT OF NATURAL RESOURCES
CENTENNIAL OFFICE BUILDING • ST. PAUL, MINNESOTA • 55155

1640

February 13, 1975

Colonel Max C. Noah
District Engineer
St. Paul District
Corps of Engineers
1210 U. S. Post Office and Custom House
St. Paul, Minnesota 55101

Re: NCSED-ER

Dear Colonel Noah:

The Department of Natural Resources has reviewed the Draft Environmental Impact Statement on Operation and Maintenance of the Red Lake and Clearwater Rivers project, and offers the following comments.

The document is generally quite complete and itself expresses the major concerns which DNR has in regard to this project. Some of these points, however, deserve more emphasis.

Perhaps the statement which best expresses our concern appears on page 41, paragraph 4.32: "There can be no doubt that the channelization of the Red Lake River resulted in the desiccation of thousands of acres of marsh which (previously) were predominantly excellent wildlife habitat." The draft EIS estimates the acreage affected at from 50,000 to 60,000 acres.

Attempts to restore the marshes have largely failed, with the exception of the Zah Gheeng and Ki-wo-Say marshes, totalling some 10,000 acres. Some additional information not given in the draft EIS documenting these failures is given on the attachment to this letter. However, the statement on p.45, paragraph 4.44 sums it up: " Examination of the control structure (weir) at mile 178.6 on the Red Lake River. . . raises questions as to the purpose of the weir. . . it does not contribute significantly to restoration of marshes north and south of the river bed."

Several thoughts emerge from the above factors and others in the draft EIS.

1. The project has greatly damaged the resources of the area, especially tens of thousands of acres of marsh, as well as the fishery in the river.

2. This in turn has very seriously affected the Indians of the Red Lake Band who relied on the natural systems for hunting, trapping and fishing as a livelihood.

3. The project is not accomplishing very well the purposes for which it was established, namely flood damage reduction and stream-flow augmentation. Only five percent of the stream-flow at Crookston is contributed by Red Lakes, and most of the inability of the Red Lake River to adequately handle peak flows is due to ditches entering the river downstream from the project.

4. To accomplish the stated purposes of the project, lake levels would have to fluctuate more than the one foot or so which apparently is all that is presently feasible, given considerations to land uses around the lakes.

Therefore, due to the apparent inoperativeness of the project, it would appear that steps could and should be taken to modify it in whatever way necessary to restore the original marsh conditions and/or provide wild rice producing areas, and that such action would not have adverse effects, since the project is not significantly accomplishing the stated objectives at present. The mix of marsh to wild rice area should be left to the Tribal Council to decide.

In addition, may we make these minor comments:

1. The natural level of the Red Lakes before the first manipulation is not stated.

2. The Red Lake basin has considerably more wild rice paddy area than the 5000 acres mentioned in paragraph 2.81, page 26. Permits have been issued for more than 11,000 acres on the Clearwater River alone, and permits on another 7000 acres are pending.

3. The statement on page 35, paragraph 3.5 that "all the land that can be economically used for agriculture is so used" is not entirely true. A recent DNR study shows that 54,000 acres along the Clearwater River could economically be developed for wild rice production.

4. To avoid confusion, the reference to the Minnesota Forest Service on page 31, paragraph 2.105 should read Minnesota Department of Natural Resources.

In the limnological data presented, the secchi disc readings were quite low and the nitrogen and phosphorous values were quite high, so a limnological water sampling program should be initiated to ascertain how representative those findings are. Summer values could be quite different, and they might vary considerably in various parts of the lake.

Again, we feel strongly that the losses that have occurred as a result this project should be rectified, and that such action should supercede present project operating objectives.

Additional Information or Changes in Surface Water in the Red Lake River Project Area

Maps prepared from the original land surveyors notes indicate that the land adjacent to the river was mostly swampy with some "ridges" of aspen and oaks paralleling the river. Apparently, some swamp conifers were present. The Red Lake River was noted to be big enough to float a steamboat. A series of small lakes were noted to be present north of the River. This area was photographed in 1939 at the end of a series of dry years. There was some water in the small lakes north of the river and some open water in the marshy lowlands above mile 185 (Zah Gheeng). In 1960, another set of aerial photos were taken after the river had been dredged and the dam was built at mile 178.8 show that most of the open water above mile 185 was in the dredged channel and in the old channel. The same 1960 photos show slightly more water in the river channel above mile 178.8 and no water in the marshy lowlands adjacent to the river channel, but there was more pockets of open water in the marshy lowlands adjacent to the river channel between mile 178.8 and 185 and the small lakes north of this stretch of river had a lot more water in them. Downstream from mile 178.8 there was some additional open water in the lake basins north of the Red Lake River channel and very little or no additional water in the lowlands adjacent to the river channel. The foregoing suggests that before the river channel was modified that all of the open water in the lowlands adjacent to the river channel was above mile 185 was drained, and that the dam located at mile 178.8 did not flood any appreciable amount of land next to the river channel, but the water table might have been raised enough to increase the amount of open water in pockets and basins away from the river's edge. To what extent floating bog may have decreased the amount of open water is an unknown factor. Two maps have been drawn from the aerial photos used and show the approximate distribution of biological communities observed.

We appreciate your interest in this matter.

Sincerely,

Jerome H. Kuehn
Planning Administrator

JHK:KDW:md
Attachment
cc: Archie D. Chelseth, Assistant Commissioner
Division Directors
PERT Members
Merlyn Wesloh, R. A.

MINNESOTA POLLUTION CONTROL AGENCY
1935 W. County [illegible] Minnesota 55113

(612) 296-7301
February 21, 1975

Colonel Max W. Noah
District Engineer
St. Paul District
Corps of Engineers
1210 U.S. Post Office & Custom House
St. Paul, Minnesota 55101

Dear Colonel Noah:

This is in response to your request for comments on the "Draft Environmental Impact Statement, Upper and Lower Red Lakes, Operation and Maintenance Activities."

The Draft EIS states, on page A-5, that during drought conditions the reservoir release rates will be cut to a maximum of 15 CFS, but never lower than 5 CFS. The Draft EIS should go further to explain what the low flow would be under all the alternatives, especially the alternatives of "No project operation and maintenance," and lower normal operating lake levels.

In addition to presenting low flows for all alternatives, we feel that there should be an assessment of the impact on low flows in the Thief River Falls area of the Red Lake River. Thief River Falls is the first community downstream from the reservoir which relies on the Red Lake River for drinking water supply and wastewater dilution.

Thank you for the opportunity to review this Draft EIS.

Sincerely yours,

Grant J. Merritt
Executive Director

MINNESOTA POLLUTION CONTROL AGENCY
1935 W. County Road B2, / Roseville, Minnesota 55113

February 18, 1975

Max W. Noah, Colonel
Corps of Engineers
District Engineer, St. Paul District
1210 U. S. Post Office
St. Paul, Minnesota 55101

Dear Colonel Noah:

The draft EIS on operation and maintenance activities relating to the Upper and Lower Red Lakes has been reviewed and the following comments are offered.

1) Streamflow augmentation benefits have not been determined for the projects cost/benefit analysis. Augmentation for waste dilution purposes does not conform with present state policy.

2) There is no documentation of the "harassing floods" or extent of their damages in the draft EIS.

3) According to the draft EIS the drawdown starting date is based on a request by the U. S. Fish and Wildlife Service for stabilized water levels downstream from the dam, and for water supply requirements for sugar beet processing. The hydrological data upon which this request is based should be included in the EIS.

4) Biological and chemical analysis of water in the reservoir do not provide sufficient data to support statements on water quality.

5) Statements on reservoir productivity cannot be supported as no productivity studies (planktonic or benthic) were done. In light of the decline in the fishery industry at the reservoir it is important that the productivity of the planktonic and benthic communities be determined.

6) Taxonomic work on the benthic community is inadequate as many of the organisms can be determined to at least the genus if not species level.

In summary, a complete cost/benefit study should be prepared to determine if it is advisable to continue operation and maintenance activities as they have been done in the past, or if a new strategy is needed in this area. This cost/benefit analysis should be based on a much more extensive environmental monitoring program as existing data on reservoir water quality, productivity, and biological diversity are too insufficient to be of any value. Particular emphasis should be placed on possible water quality effects from the production of wild rice, marsh restoration, and fluctuation of water levels in the reservoir.

Yours very truly,

L. E. Richie
Deputy Executive Director

BEMIDJI STATE COLLEGE BEMIDJI, MINNESOTA 56601

BIOLOGY - CENTER FOR ENVIRONMENTAL STUDIES - CHEMISTRY - COMPUTER SCIENCE - GEOLOGY - MATHEMATICS - PHYSICS
DIVISION OF SCIENCE & MATHEMATICS
218-755-2920

13 January 1975

District Engineer
St. Paul District
Corps of Engineers
1210 U.S. Post Office and Custom House
St. Paul, Mn. 55101

Dear Sir,

This letter will acknowledge receipt of the Draft Environmental Impact Statement for Upper and Lower Red Lakes Operation and Maintenance Activities-October 1974, mailed under cover of your letter of 27 December 1974.

The Draft EIS appears to be informative and to be properly directed to items of greatest environmental concern, and there appears to be little doubt that the main thrust of the Corps' effort toward restoration of previously drained marshes, is an environmentally sound one.

There are, however, many questions relating to trends in water quality and wildlife populations which do not appear to have been resolvable during the period of the field study which supported the Draft statement. I hope that the Corps will select a number of these unresolved questions as worthy of more intensive and prolonged study. The results of such studies would probably aid materially in the detailed evaluation of other projects in the Red River Basin.

Sincerely,

Charles H. Fuchsman, Director
Center for Environmental Studies

CHF/KJM

cc: CES file

AGRICULTURAL EXTENSION SERVICE

UNIVERSITY OF MINNESOTA

Agricultural Extension Service
RED LAKE INDIAN RESERVATION
Redlake, Minnesota 56671
PHONE 679-3366

February 3, 1975

Mr. Max W. Noah
Colonel, Corps of Engineers
District Engineer
Department of the Army
1210 U. S. Post Office and Custom House
St. Paul, Minnesota 55101

Dear Colonel Noah:

Enclosed are my comments regarding the Draft Environmental Impact Statement for Operation and Maintenance, Red Lake and Clearwater River Project, Minnesota.

I believe that the draft statement is very inadequately prepared in several areas. Certain areas contain statements that are not factual and should be corrected.

Sincerely,

Floyd W. Jorgensen
Associate Professor & Extension Agent
University of Minnesota
Agricultural Extension Service

Comments regarding

Draft Environmental Impact Statement

Upper and Lower Red Lakes

Operation and Maintenance Activities

Red Lake River Basin, Minnesota

The Cover:

The boundary crossing upper Red Lake is not a curved line but rather by treaty reads from a given point on the south shore due north to given point on north shore, follow the shore line westerly to given point and then due west.

This misprinted map has caused severe damage in area relations and needs to be corrected.

1.4 - The sentence, overflowed or marshy lands ceded by the Chippewa Indians to the State of Minnesota.

In checking with several Indian leaders they maintain no land was ceded to the State of Minnesota. Their statements maintain the land was ceded to the United States Government.

1.9 - The Battle River does not flow into upper Red Lake. It flows into lower Red Lake.

1.10 - The north unit of the marsh will not fill from the inlet unit from the lake, but rather on numerous occasions rather discharges into the lake. During periods of low lake levels, it is impossible to flood the north unit.

1.11 - The last sentence indicates that there are stop logs and fish barriers at the outlet structure. There has never been either logs or barriers since the construction of the area. There should be for this type of an operation.

1.12 - Indicates a freeboard of two feet on the levees but actually this figure is much less. Either the levees are not up to grade or the gauges are not accurate.

1.17 - The operator does not rely on his own judgement but rather consults with the Tribal officers and the U.S. F. W.

2.73 - There are both bald eagles and timber wolves and a complete study is needed to determine an accurate amount.

2.74 - In checking the records one will find that prior to World War I, the Chippewa Indians did supply their own agricultural foods and in fact prevented other Indians from starvation by supplying grain and vegetables.

2.79 - There are Indian burial ground on the west end of lower Red Lake that should be preserved. These are of a mound type and are historically important.

Also, on the east end of lower Red Lake, there are numerous large sand dunes that should preserved.

4.8 - The Tribal Officers have requested a fish ladder of proper design to do the job. They feel that there was direct neglect in past trial efforts. It is a common feeling that the ladder was not designed for fresh water fish.

4.26 - There has been no real attempt to introduce wild rice to the area. Up until this time there has never been funds for such an effort. There is a need to establish wild rice to enhance the waterfowl untilization of the area.

4.27 - It is difficult to study the effects of drainage water of the Zah Gheeng wild rice paddies when there are none in existence.

7.5 - The portion of upper and all of the lower Red Lake that are within the

reservation boundaries are not open to pleasure boating and sport fishing. This area is reserved for commercial fishing.

Exhibit 7 A - 9

This map does not indicate the proper boundary of the upper lake.

Exhibit 9 A - 11

It is unfortunate that representation from the society did not consult the tribe regarding the burial mounds.

NORTHWESTERN UNIVERSITY
EVANSTON, ILLINOIS 60201

PUBLIC LANDS PROJECT

2040 SHERIDAN ROAD
EVANSTON, ILLINOIS 60201
TELEPHONE (312) 492-3559

District Engineer
Army Engineer District, St. Paul
1210 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

February 23, 1975

In re: DEIS Concerning
Operation and Maintenance
Activities, Upper and Lower
Red Lakes, Minnesota

Dear One:

In reading the draft environmental impact statement concerning the operation and maintenance activities for the Upper and Lower Red Lakes project, I am struck with the honesty with which the Corps admits and acknowledges the string of Corps failures and miscalculations which have attended this project, all of which have brought harm to the Red Lakes Band of Chippewa Indians. I don't mean this as a back-handed compliment, for NEPA was meant to be a full disclosure act, and any attempts to rectify the damages done to the Indians must be based on an honest acknowledgement of responsibilities. I trust and hope that the material you present in the EIS will be ample as admissions, to stimulate the Indians to seek *administrative, legal, and/or* legislative redress.

(1) I suppose the basic problem with this EIS is that it appears to propose more of the same, while it should be concerned with analyzing the environmental impacts of fully restoring the Indian's land and water to a pre-project status. More specifically, you indicate (page 35) "The Tribal Council, under Chairman Roger Jourdain, governs the reservation and has authority over land use on the Reservation. The Council's development plans are for (in order of priority) fisheries, ricing and marsh restoration... Considerable capital expenditures are needed for development, and no funds are immediately available for that purpose... Any concerned agency deserving to implement a restoration plan should take care to see that such plans coincide with the overall land-use plans of the Tribal Council."

Since you acknowledge that the drying out of the marshes, the reduction in potential and actual ricing areas, and the loss of fishing potential have all been unintended consequences of the Corps project which was intended to benefit others, but not even intended to be for the benefit of the Indians, it seems to me that the Corps of Engineers should be the "concerned agency desiring to implement a restoration plan." If you have no specific statutory authority, or discretionary funding, then General Morris should seek such funding from the Congress.

(2) When you consider alternatives to the present project operations, you do not explicitly consider the alternatives of engaging in whatever work is necessary

to restore this area to its pre-project state. You consider abandonment, of course, just briefly. You do state (p. 49), about abandonment "The Corps would save about $29,000 per year based on an average of expenses in the last four years. However, flood control benefits of $67,000 or more would be lost." But the proper figures to examine would include, for costs, those benefits forgone, by maintenance of this project. Only assessing those items for which a monetary value can be assigned, I am confident that you could find up to the hundreds of thousand dollars forgone, involuntarily by the tribe, because of the maintenance of this project (commercial and family ricing, fishing, hunting, trapping, guiding and tourist/hunting services, etc. and subsistence activities.) That is what ought to be weighed against the flood control, etc., benefits.

(3) As I review the project benefits claimed for this project, they all seem to be benefits for whites, while all the (very heavy) bad consequences affect the the Indians.

(a) Is that statement true, or nearly true?
(b) If so, aren't you bound by at least a compelling moral obligation to rectify this situation?

Thank you for considering these comments.

Sincerely,

H. Paul Friesema

HPF/cs

H. Paul Friesema
Associate Professor

BIBLIOGRAPHY

Allison, Ira. 1932. The Geology and Water Resources of Northwestern Minnesota. University of Minnesota Press.

Arneman, H.F. 1963. Soils of Minnesota. Agricultural Extension Service. University of Minnesota, St. Paul.

Austin, Morris E. 1972. Land Resource Regions and Major Land Resource Areas of the United States (exclusive of Alaska and Hawaii). Agricultural Handbook No. 296. Soil Conservation Service. U.S. Department of Agriculture, Washington, D.C. 82 pg. and map.

Baker, Donald G. and Joseph H. Strub, Jr. 1965. Climate of Minnesota. Part V., Precipitation, Facts, Normals, and Extremes. Agricultural Experiment Station. University of Minnesota, St. Paul.

Baker, Donald G. and Joseph H. Strub, Jr. 1965. Climate of Minnesota. Part III. Temperature and Its Application. Agricultural Experiment Station. University of Minnesota, St. Paul.

Bidwell, L.E., T.C. Winter, and R.W. Maclaey. 1970. Water Resources of the Red Lake River Watershed, Northwestern Minnesota. Hydrologic Investigations. Atlas HA-346. U.S. Geological Survey, Washington, D.C. Sheets 1-4.

Broad Program Area 2--Framework Program. 1967. Multi-Soil and Water Conservation Districts, Red Lake Broad Program Area, Minnesota. Water Conservation District Supervisors of Beltrami, Koochiching, Lake of the Woods, and Roseau Districts.

Brooks, Erwin R., Undated. A Survey of Current and Potential Wild Rice Production. Bureau of Indian Affairs.

Cowardin, Lewis M., Robert E. Stewart, and Harvey K. Nelson. 1967. Vegetative Studies on Waterfowl Development Area, Red Lake Indian Reservation, Minnesota. Northern Prairie Wildlife Research Center, U.S. Bureau of Sport Fisheries and Wildlife, Jamestown, North Dakota.

Eddy, S. and A.C. Hodson. 1961. Taxonomic Keys to the Common Animals of the North Central States. Burgess Publishing Company, Minneapolis.

Fevan, F. Robert. 1969. A Study of Wild Rice in Minnesota. Minnesota Resource Commission in Cooperation with Upper Great Lakes Regional Commission.

Environmental Protection Agency. 1971. Methods for the Chemical Analyses of Water and Wastes. Water Quality Office. Analytical Quality Control Laboratory, Cincinnati, Ohio.

Errington, Paul L. 1962. Muskrat Populations. The Iowa State University Press. Ames, Iowa.

Errington, Paul L. 1973. The Red Gods Call. Iowa State University Press. Ames, Iowa.

Gillman, Dellmer. 1972. Personal Communication. Beltrami County Agricultural Stabilization and Conservation Service.

Grosslein, M., and L.L. Smith, Jr. 1959. The Goldeye, Amphiodon Alosoides (Rafinesque), in the Commercial Fishery of the Red Lakes, Minnesota. U.S. Fish and Wildlife Service, Fishery Bulletin 157. Vol. 60: 33-41.

Hagen, Delmar. 1971. Red Lake Watershed District Overall Plan. Board of Managers, Red Lake Watershed District.

Hanson, David. 1972. Personal Communication. Assistant Beltrami County Agent, Recreation Specialist. Beltrami County.

Henegar, D.L. and K.W. Harmon. 1971. A review of channelization and its environmental impact. p.6

Heyerdahl, E.G. and L.L. Smith, Jr. 1971. Annual Catch of Yellow Perch from Red Lakes, Minnesota, in Relation to Growth Rate and Fishing Effort. University of Minnesota Agricultural Experiment Station Technical Bulletin 285.

Hime, Ruth L. 1972. The Leaky Sponge. Wisconsin Conservation Bulletin 37: 18-19.

Jorgenson, Floyd W. 1971. Agency Annual Report, Land Operations. Outdoor Recreation and Wildlife, Minnesota Agricultural Extension Service.

Knapp, R.J. 1960. Plankton Fluctuations in the Lower Red Lake and Food Utilization by Young of the Year Perch in 1956 and 1957. M.S. Thesis. University of Minnesota.

Kuchler, A.W. 1964. Potential Natural Vegetation of the Conterminous United States (map and manual). Special Publication No. 36 American Geographical Society, New York. 155 pp.

Lundberg, Denneth R. and Patrick Trihey. 1972. Water Quality Control Through Single Crop Agriculture. An Annual Report to Office of Research on Monitoring. Environmental Protection Agency, Washington, D.C.

Maderal, Marion. 1963. Quality of Waters, Minnesota. A compilation, 1955-62. State Department of Conservation. Division of Waters. Bullentin 21, Table 10.

Magnuson, J. and L.L. Smith, Jr. 1963. Some Phases of the Life History of the Trout Perch. Ecology. 44(1): 83-95.

Minnesota Department of Natural Resources. 1971. Red River of the North Regional Flood Analysis. Division of Waters, Soils, and Minerals, St. Paul, Minnesota.

Minnesota Pollution Control Agency. 1971. Water Quality Management Plan (interim), Red River of the North Basin. Division of Water Quality.

Pennak, R.W. 1953. Freshwater Invertebrates of the United States. Ronald Press Company, New York.

Peterka, J.J. and L.L. Smith, Jr. 1970. Lake Whitefish in the commercial Fishery of the Red Lakes, Minnesota. Trans. Am. Fish. Soc. 99(1): 28-43

Polfliet, David J. 1972. Phosphorus Movements in Water-Logged Soils. A Graduate Research Paper (unpublished). Bemidji State College, Bemidji, Minnesota.

Prescott, G.W. 1962. Algae of the Western Great Lakes Area. Wm. C. Brown Company, Dubuque, Iowa.

Rawson, D.S. 1955. Algal Indicators of Trophic Lake Types. Limnol. and Oceanogr. 1: 18-25.

Reed, N.P. 1971. Reprint of speech made before the House Government Operations Subcommittee, Thursday, June 3, 1971.

Saint Paul Dispatch. Sunday, Febraury 13, 1966. Wildlife Project Set for Red Lake. St. Paul, Minnesota.

Smith, G.M. 1950. Fresh-Water Algae of the United States. McGraw-Hill Book Company, Inc.

Smith, L.L., Jr., L.W. Krefting. and R.L. Butler. 1952. Movements of Marked Walleyes, Stizostedion vitreum vitreum (Mitchill), in the Fishery of the Red Lakes, Minnesota. Trans. Am. Fish. Soc. 81: 179-196.

Smith,L.L., Jr. and L.W. Krefting. 1953. Fluctuations in Production and Abundance of Commercial Species in the Red Lakes, Minnesota, with Special Reference to Changes in the Walleye Population. Trans. Am. Fish. Soc. 83: 131-160.

Smith, L.L., 1957. Bottom Sample Red Lake Summaries - all years. University of Minnesota. Unpublished (mimeographed).

Smith, L.L., Jr. 1958. Indian Fishery on the Red Lakes. Minnesota Conservation Volunteer, 21 (122): 43-47.

Smith, L.L., Jr., and R. Pycha. 1961. Factors Related to Commercial Production of the Walleye in Red Lakes, Minnesota. Trans. Am. Fish. Soc. 90(2): 190-217.

Smith, L.L., Jr. 1973. Personal communication, August 21, 1973.

Stewart, Robert E. and Leo M. Kirsch. 1964. Vegetative Studies on Waterfowl Development Area in Red Lake Indian Reservation, Minnesota. U.S. Bureau of Sport Fisheries and Wildlife, Northern Prairie Research Center, Jamestown, North Dakota. Unpublished manuscript.

Stewart, Robert E., Leo M. Kirsch, and Lewis M. Cowardin. 1965. Vegetative Studies on Waterfowl Development Area in Red Lake Indian Reservation, Minnesota. U.S. Bureau of Sport Fisheries and Wildlife Northern Prairie Research Center, Jamestown, North Dakota. Unpublished manuscript.

Thief River Falls Gazette. January 31, 1966. Red Lake Indians to Restore Marsh. Thief River Falls, Minnesota. Page 1.

Thompson, David. 1972. Letter to Kenneth R. Lundberg, Bemidji State College.

U.S. Department of Agriculture. 1971. Minnesota Agricultural Statistics, Minnesota Department of Agriculture and the U.S. Department of Agriculture.

U.S. Department of the Army. 1947-1952. Red Lake-Clearwater Rivers--Trapping, File 680.2 Record Section. Jurisdiction, Government Regulations, etc., St. Paul District Corps of Engineers.

U.S.Department of the Army. 1957a. Corps of Engineers Folder 821.25. Red Lake and Clearwater Fishway.

U.S. Department of the Army. 1957b. Report of effect of Red Lake-Clearwater Flood Control Project on Fish and Wildlife Values in the Red Lake Indian Reservation Area. St. Paul District Corps of Engineers, St. Paul, Minnesota.

U.S. Department of the Army. 1964. Flood Control and Water Conservation, Red Lake River, Minnesota. Red River of the North Watershed, Red Lake Dam and Red Lakes Reservoir. Reservoir Regulation Manual. St. Paul District Corps of Engineers, St. Paul, Minnesota.

U.S. Department of the Army. 1965. General Design Memorandum Red Lake-Clearwater River Project Red Lake Marsh Restoration, Minnesota. St. Paul District Corps of Engineers.

U.S. Department of the Interior (USDI). 1957. A Special Report on Marsh Rehabilitation Possibilities Adjacent to the Red Lake River, Within the Red Lake Indian Reservation in Minnesota. U.S. Bureau of Sport Fisheries and Wildlife, Twin Cities, Minnesota. (In U.S. Department of Army, 1957b).

Van Oosten, J. and H.J. Deason. 1957. History of Red Lakes Fishery, 1917-1956, with observations on population status. U.S. Fish and Wildlife Service. Spec. Sci. Rept. Fish. No. 229.

GLOSSARY

Alkalinity. The capacity of the water to accept protons. Alkalinity is usually imparted by the bicarbonate, carbonate, and hydroxide ions.

Aging of lakes. The natural process by which lakes fill and eventually become dry land.

Anaerobic. A condition in which no oxygen (O_2) is present.

Aquifer. A water-bearing layer of rock or sand, etc., found beneath the surface of the ground.

Benthic invertebrates. Bottom-dwelling invertebrate animals.

cfs. Cubic feet per second.

Channelization, Channel improvement. The dredging of a stream channel to widen, straighten, or deepen it in order to facilitate the flow of water in the channel.

CPE. Catch per unit effort. The catch of fish in numbers or in weight taken by a defined unit of fishing effort.

Diatoms. One-celled golden-brown algae which have a silica cell wall bearing characteristic designs. Division Chrysophyta, Class Bacillariophyceae.

Drawdown (as used here). The removal of water from rice paddies during early August. See Winter Drawdown.

Evapotranspiration. The combined loss of water by evaporation both from plant leaves and from land and water surfaces.

Fish production. The total amount of growth of new fish in a stock in a unit of time.

Fishway. A structure which permits the movement of fish above or around an impeding structure in a stream or river.

Floating stage (wild rice). A period in the growth of the wild rice plant in which the leaves float on the water surface.

Flushing time. The interval during which the water mass of a lake or reservoir is completely exchanged.

Gear competition. The interaction between the pieces of fishing gear used in a fishery. As the number of pieces of gear increases, the catch in each piece will decline.

Glacial till. Unsorted gravel and soil material which remains after the recession of a glacier.

Grab-type plankton sampler. A device which collects samples of plankton by entrapping the organisms within a closed space.

Green algae. Algae with grass-green chloroplasts and which store starch. Division Chlorophyta.

Growing degree-days (T_b = 50°F). A common approximate measure of the energy available to crops in a given latitude, or

$$\frac{\text{Maximum daily temperature + minimum daily temperature}}{2} - 50$$

(At T_b = 50°F, it is assumed that no growth occurs below 50°F.)

Hemic peat. A dark fine-grained peat in which degradation of plant fiber has gone beyond the recognizable state.

Homothermal. Condition of a body of water in which the temperature of the water is similar from the surface to the bottom.

Kjeldahl nitrogen. Nitrogen found in living and non-living material which can be converted to ammonia nitrogen.

Limnology. The study of the productivity of inland waters, by the study of their physical, chemical, and biological aspects.

Littoral zone. The shoreward regions of a lake.

Mean depth. The relationship between the volume and the area of a lake. The formula is

$$\bar{d} = \frac{V}{A} \quad \begin{matrix}\text{(volume)} \\ \text{(area)}\end{matrix}$$

Mesotrophic conditions. Waters of intermediate concentrations of nutrients.

Morainal hills. Hills formed by debris of earth and rocks collected in ridges or heaps by a glacier.

Net plankton. The plankton which can be caught and retained in a plankton net.

Nymph (e.g., mayfly). An immature stage of insect, often aquatic.

Outwash plains. Sorted fine sand to medium gravel formed as glacial outwash or ice-contact features.

Parameter. Any measured variable used in determining other variables.

pH. A measure of the acidity or alkalinity of water; pH 7 is neutral; lower is acidic, higher is alkaline. (Actually, the negative logarithm of the hydrogen ion concentration of a substance.)

Phytoplankton. Plant microorganisms, usually one-celled algae, living unattached in the water.

Plankton. Bouyant organisms found suspended in open water or floating on the surface.

ppm. Parts per million; approximately equivalent to milligrams per liter.

Primary productivity. The rate of assimilation and storage of carbon by the process of photosynthesis in green plants.

Rectification. The straightening of a river by cutting off the meanders.

Riparian (riparian land). Land which touches any watercourse.

Ribbon stage (wild rice). An early period in the growth of the wild rice plant in which the leaves are small and totally submerged.

Sapric peat. Peat soil containing a large proportion of recognizable plant debris.

Spoil banks. Banks of rock and dirt dredge from a river or lake.

Tagging study. An experimental procedure in which organisms are captured, marked with an identifiable tag and then released.

T_b. the base temperature for use in growing degree days equation; e.g., for corn a base of 50°F is used; this is assumed to be below which little or no growth occurs.

Topographic relief. The elevational characters of landforms.

Trophic status. The nutrient conditions of lake or river water.

Winter drawdown. The withdrawal of enough extra water from a reservoir during the winter to cause a lowering of the water surface, to accommodate heavy runoff in the spring.

Year class strength. The abundance of fish which are produced within a particular calendar year.

Zooplankton. Small animals which can remain suspended in water or float upon it.

TECHNICAL APPENDIX
FINAL
ENVIRONMENTAL IMPACT STATEMENT

RED LAKE AND CLEARWATER RIVER PROJECT

MAINTENANCE AND OPERATION ACTIVITIES

DEPARTMENT OF THE ARMY
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101

FINAL
ENVIRONMENTAL IMPACT STATEMENT
OPERATION AND MAINTENANCE
ACTIVITIES
RED LAKE AND CLEARWATER PROJECT
MINNESOTA

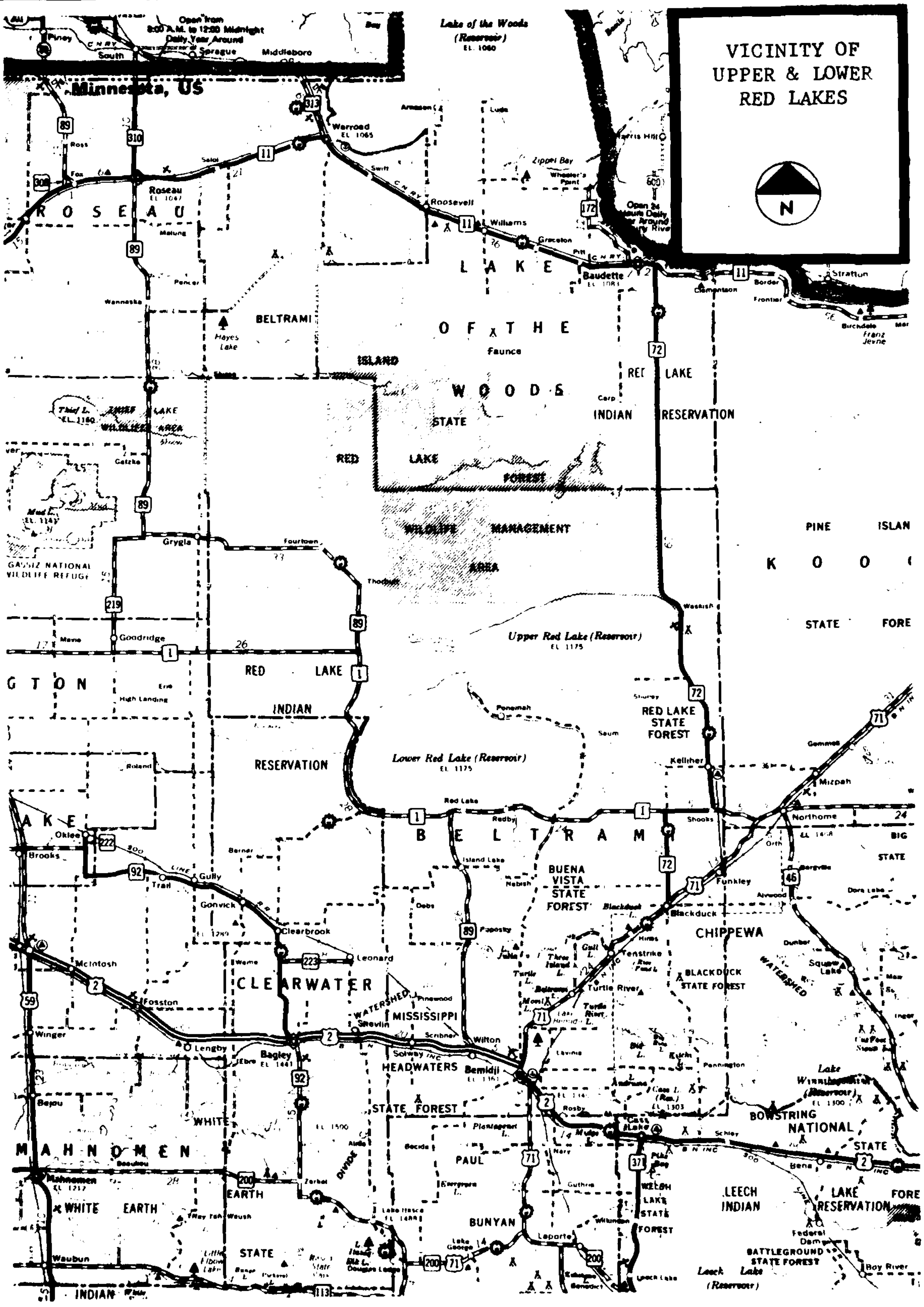
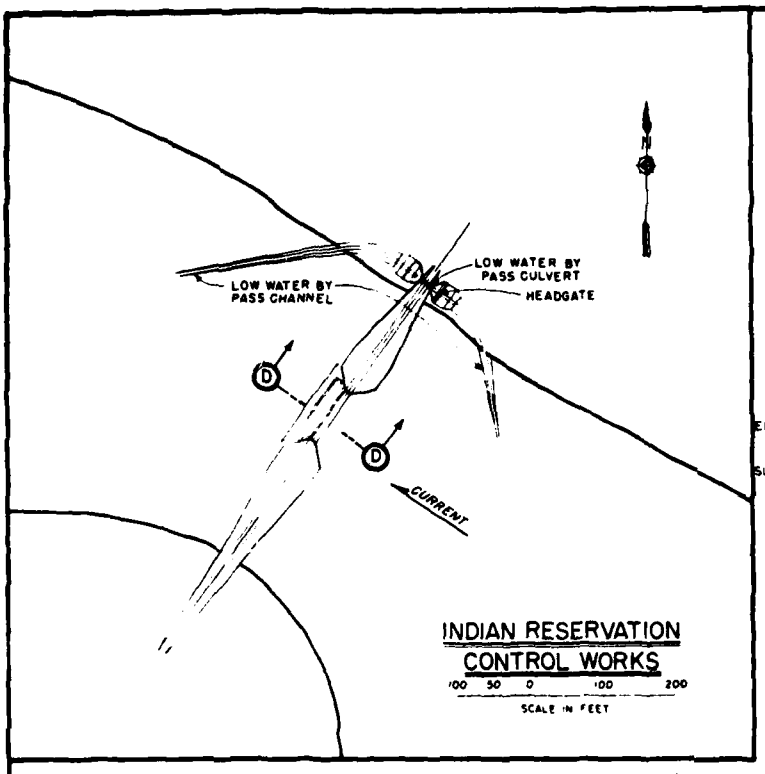
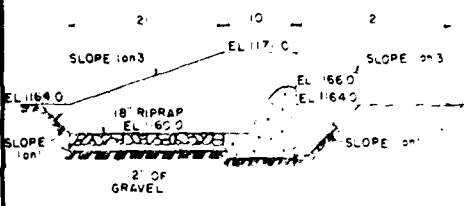

VICINITY OF
UPPER & LOWER
RED LAKES
N
Lake of the Woods (Reservoir)
Minnesota, US
Warroad
Roseau
Baudette
ROSEAU
LAKE OF THE WOODS
BELTRAMI
BELTRAMI ISLAND STATE FOREST
RED LAKE WILDLIFE MANAGEMENT AREA
RED LAKE INDIAN RESERVATION
Upper Red Lake (Reservoir)
Lower Red Lake (Reservoir)
RED LAKE STATE FOREST
Grygla
Goodridge
Red Lake
BUENA VISTA STATE FOREST
CHIPPEWA
BLACKDUCK STATE FOREST
Blackduck
Clearbrook
Bagley
Bemidji
Cass Lake
CLEARWATER
MISSISSIPPI HEADWATERS STATE FOREST
WHITE EARTH STATE FOREST
MAHNOMEN
Mahnomen
PAUL BUNYAN
LEECH LAKE INDIAN RESERVATION
BOWSTRING NATIONAL STATE FOREST
BATTLEGROUND STATE FOREST
Leech Lake (Reservoir)
KOOCHICHING
PINE ISLAND STATE FOREST
Lake Winnibigoshish (Reservoir)

EXHIBIT 1



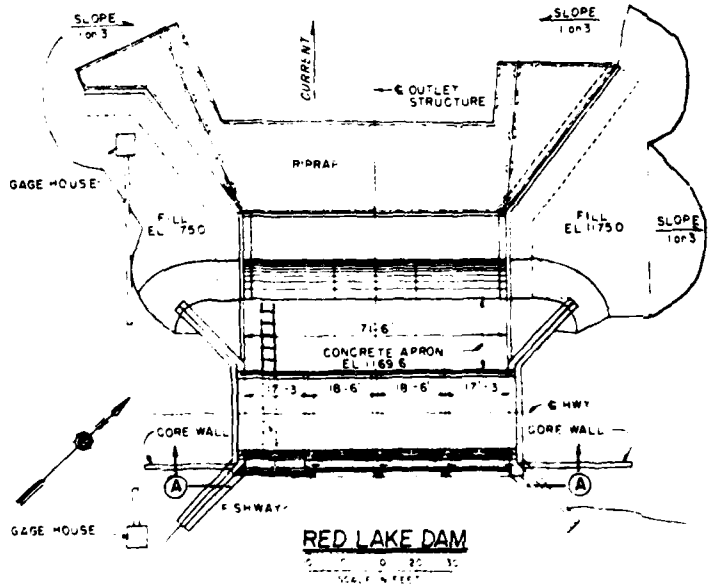
INDIAN RESERVATION
CONTROL WORKS

100 50 0 100 200
SCALE IN FEET



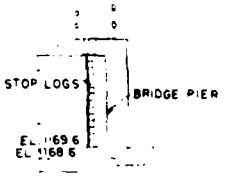
SECTION D-D

0 20
SCALE IN FEET



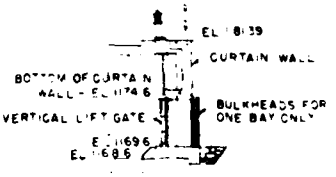
RED LAKE DAM

0 30 60
SCALE IN FEET



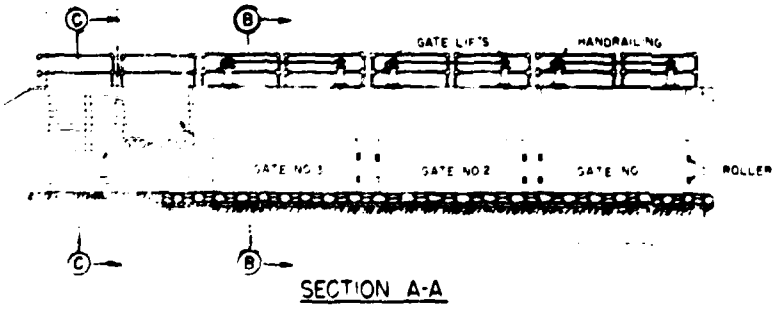
SECTION C-C

0
SCALE IN FEET



SECTION B-B

SCALE IN FEET



SECTION A-A

FLOOD CONTROL PROJECT
RED LAKE RIVER, MINN

STRUCTURES

IN 2 SHEETS SHEET NO 2

SCALE AS SHOWN

CORPS OF ENGINEERS U S ARMY
OFFICE OF THE DISTRICT ENGINEER
ST PAUL DISTRICT ST PAUL, MINN
JUNE 961

Reservoir Regulation Schedule - Red Lake Dam

Regulation Schedule	Reservoir Elevation	Condition	Operation
Normal or Routine (Fall)	1173.5 to 1174.0	Normal	Beginning about 15 Sept. set outflow to assure drawdown of reservoir level to 1173.5 by 1 April. Drawdown beginning at this time is based on request of the U.S. Fish and Wildlife. Bureau of Sports Fisheries for stabilized water levels downstream from the dam and also for the requirements for sugar beet processing which usually starts the latter part of Sept. and lasts approximately 120 days.
(Spring) about 1 April	1173.5 to 1174.5	Normal	Cut outflow to downstream requirements for Fish and Wildlife and other needs. Outflow may range from 15 c.f.s. to 1000 c.f.s. Annual normal recharge is about 1.0 foot and will raise reservoir level to 1174.5. Normal evaporation will cause drawdown to 1174.0 Regulate to maintain 1174.0 until September.
Flood Control			
(Spring)	1173.5 to 1176.4	Above normal runoff predicted	Reservoir down to 1173.5 set outflow as noted above. Store runoff as necessary to elevation 1176.4. max. operating level. Thereafter lower reservoir level to 1174.0 as soon as possible. Maximum discharge dependent on downstream conditions. Maximum regulated stage at Highlanding, 8.75 feet, is control for bankfull stage in Kratka area below improved channel reach. Channel capacity below Red Lake Dam designed for 1000 c.f.s. However, presently when channel is not affected by weed growth, flows in excess of 1600 c.f.s. can be discharged. Flood stage at Crookston is 14.0

- Reservoir Regulation Schedule - Red Lake Dam (cont'd)

Regulation Schedule	Reservoir Elevation	Condition	Operation
Flood Control (Spring) (cont'd)	1173.5 to 1176.4	Above normal runoff predicted	feet. The time lag from Red Lake Dam to Highlanding is 1.5 days, to Crookston 5½ days. and to Grand Forks about 7 days.
Flood Control (Spring or Summer)	1176.4 to 1179.03	Design Storm	Should the reservoir level be at 1176.4 and the design storm occur. the lake level will rise to elevation 1179.03. Outflow will depend on downstream conditions. After downstream flooding has passed. the dam will be opened to the maximum allowable until reservoir level has dropped to 1174.0
Water Supply (Spring)	1173.5 to 1174.0	Light runoff	Should the spring runoff be insufficient to raise the reservoir level to 1174.0. the outflow will be limited to requirements downstream in order to maintain the reservoir level as close to 1174.0 as possible. Evaporation losses may reduce level to 1173.5. Then outflows will be limited to the requirements for water supply and polution abatement. Outflow about 60 c.f.s.
(Spring or Summer)	1173.5 to 1172.0	Semi Drought Conditions	Should continued dry or near drought conditions exist. lower the reservoir to 1172.0 or lower. The outflow from the dam shall not exceed 50.000 acre-feet during a calendar year or a proportionate share thereof for the part of the year that the reservoir is between these elevations. (See table 4)
(Anytime)	Below 1171.0	Drought Conditions	If conditions occur where inflow and evaporation rates are such that the level of the reservoir continues to drop, the outflow when the level is down to 1171.0 will be cut to a maximum 15 c.f.s. but not less than 5 c.f.s. during this period.

ACTUAL DOLLAR EXPENDITURES
RED LAKE AND CLEARWATER RIVERS PROJECT

Fiscal year	Federal first cost	O&M cost	Fiscal year	Federal first cost	O&M cost
1945	$ 5,896		1960	$ 46 (2)	$ 6,799
1946	83,920		1961	-	12,434
1947	8,384		1962	-	6,954
1948	70,116		1963	767	8,115
1949	462,704		1964	3,984	13,142
1950	579,252		1965	41,790	28,459
1951	546,192	$ 792	1966	88,431	8,668
1952	699,621	3,544	1967	141,473	11,440
1953	280,077	3,584	1968	3,556 (3)	15,468
1954	13,076	6,461	1969	-	37,962
1955	11,830 (1)	7,675	1970		16,397
1956	-39	6,993	1971		15,749
1957	44	6,597	1972		25,004
1958	7,813	7,359	1973		35,260
1959	71,143	7,845	1974		29,000
			1975		27,000
				3,120,079 (4)	

(1) Original project completed.
(2) Control structure replacement completed.
(3) Marsh restoration completed.
(4) Local interests also contributed $30,020.

Potential Natural Vegetation Types in the Red Lakes Subbasin

GREAT LAKES SPRUCE-FIR FOREST (*PICEA-ABIES*)

Physiognomy: Dense needleleaf evergreen forests, sometimes low but usually medium tall, with modest admixtures of broadleaf deciduous trees

Dominants: Balsam fir (*Abies balsamea*)
White spruce (*Picea glauca*)

Other Components: *Acer rubrum, A. spicatum, Betula papyrifera, Pinus resinosa, P. strobus, Populus tremuloides, Sorbus americana, Thuja occidentalis*

Occurrence: Northern parts of Minnesota, Wisconsin, and Michigan

CONIFER BOG (*LARIX-PICEA-THUJA*)

Physiognomy: Dense to open, low to medium tall forests of needleleaf evergreen or deciduous trees. The more open parts have a dense undergrowth

Dominants: Larch (*Larix laricina*)
Black spruce (*Picea mariana*)
Arbor vitae or white cedar (*Thuja occidentalis*)

Other Components: *Acer rubrum, Carex* spp., *Chamaedaphne calyculata, Ilex verticillata, Kalmia polifolia, Ledum groenlandicum, Nemopanthus mucronata, Sphagnum* spp.

Occurrence: Northern parts of Minnesota, Wisconsin, Michigan

BLUESTEM PRAIRIE (*ANDROPOGON-PANICUM-SORGHASTRUM*)

Physiognomy: Dense vegetation of tall grasses and many forbs

Dominants: Big bluestem (*Andropogon gerardi*)
Little bluestem (*Andropogon scoparius*)
Switchgrass (*Panicum virgatum*)
Indian grass (*Sorghastrum nutans*)

Other Components: *Amorpha canescens, Antennaria neglecta, Aster ericoides, A. laevis, Baptisia leucantha, B. leucophaea, Boutelova curtipendula, Erigeron strigosus, Galium tinctorium, Helianthus grosseserratus, Koeleria cristata, Liatris aspera, L. punctata, L. scariosa, Panicum leibergii, P. scribnerianum, Phlox pilosa, Psoralea argophylla, P. floribunda, Ratibida columnifera, R. pinnata, Rosa arkansana, Silphium laciniatum, Solidago altissima, S. missouriensis, S. rigida, Sporobolus heterolepis* (northern part), *Stipa spartea* (northern part)

Occurrence: North Dakota and Minnesota southward to Oklahoma

Source: Küchler, 1964

Vegetation and Wildlife Observed Near Red Lake by Paul L. Errington, Fall 1929 (Errington, 1978)

Vegetation

Drepanocladus (or *Sphagnum*), "sphagnum" moss*

Thuja occidentalis, White cedar

Larix laricina, Tamarack

Pinus strobus, White pine

Pinus resinosa, Norway pine

Fish

Pike

Whitefish

Birds

Ducks (unnamed)

Mallard

Black ducks

Ruffed grouse

Sharp-tail grouse

Canada jay

Chickadee

Great grey owl

Horned owl

Richardson's owl

Mammals

Muskrat

Rabbit

Snowshoe hare

Mink

Weasel

Skunk

Deer mouse

Shrews (including short-tail)

Squirrel

Red squirrel

Chipmunk

Beaver

Porcupine

Raccoon

Otter

Fisher

Fox

Coyote

Wolf

Indian dogs

Lynx

Moose

Deer

Woodland caribou

---

* Probably *Drepanocladus*

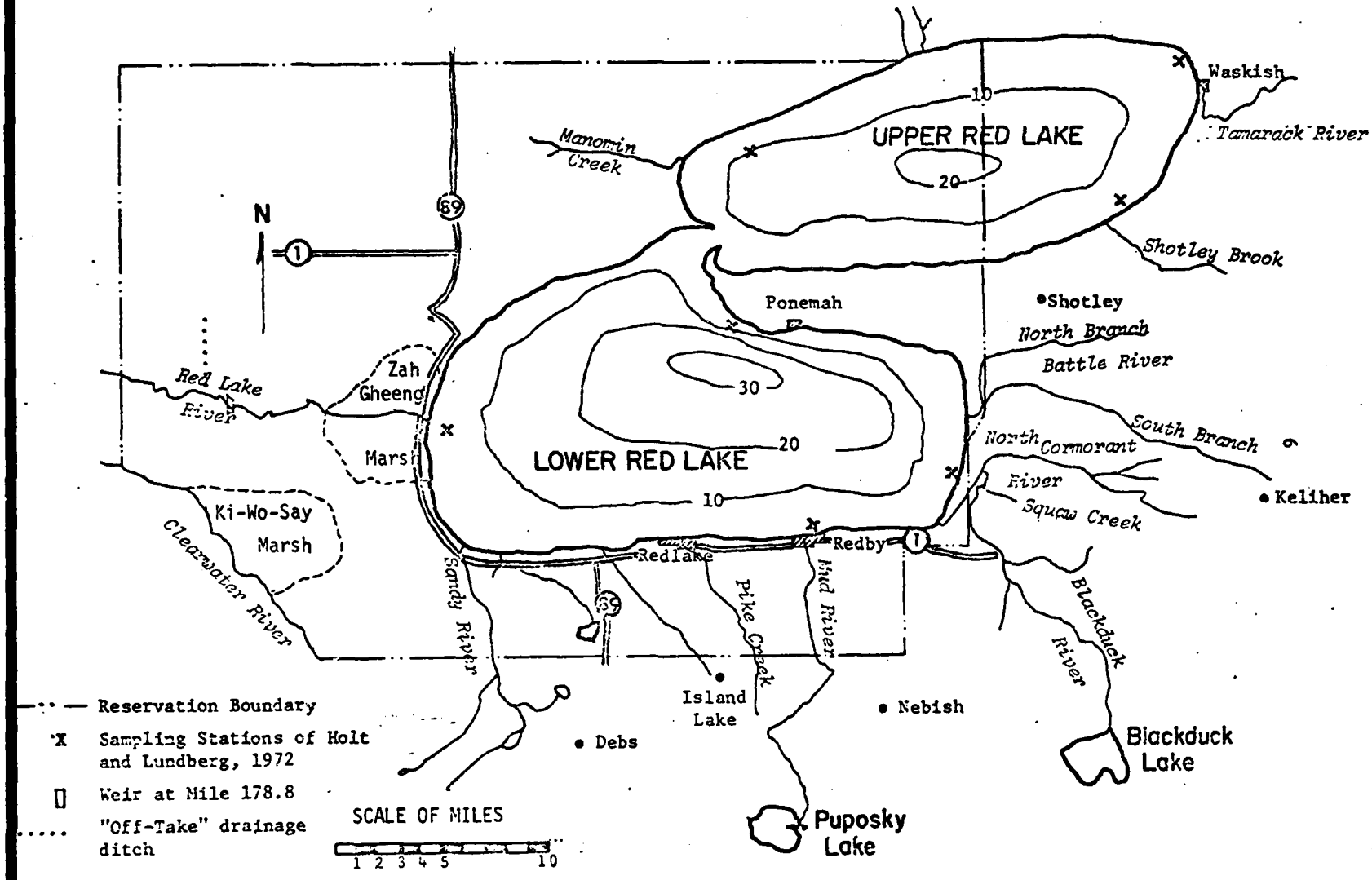
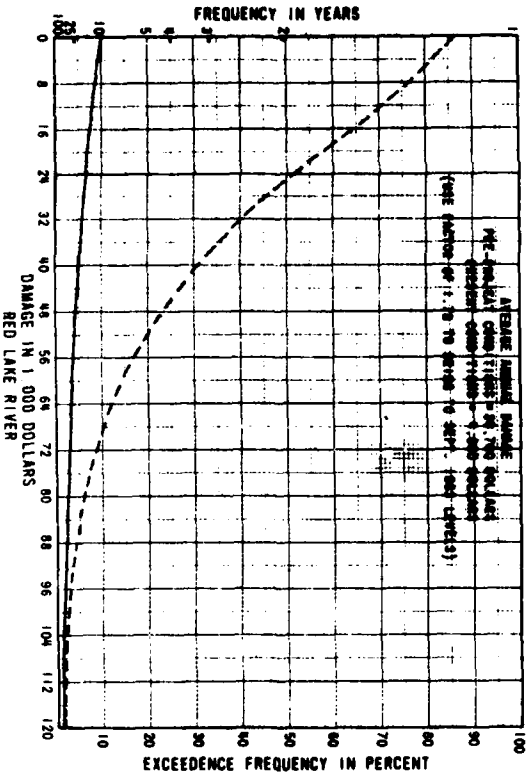
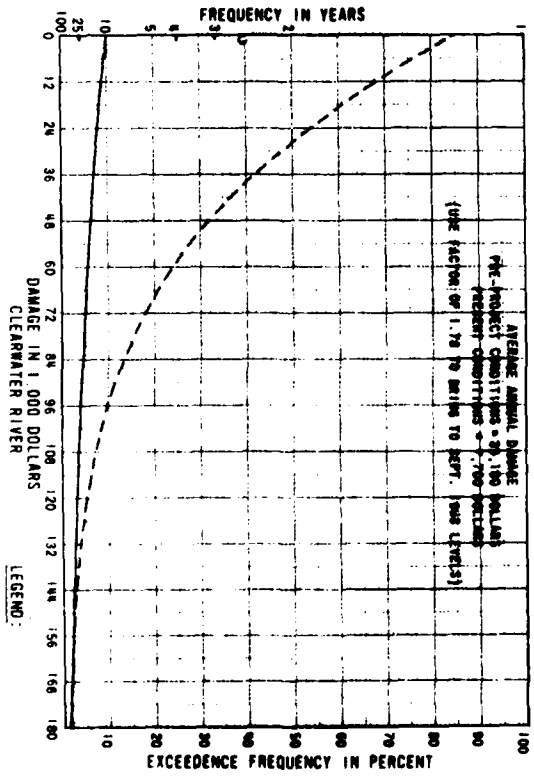


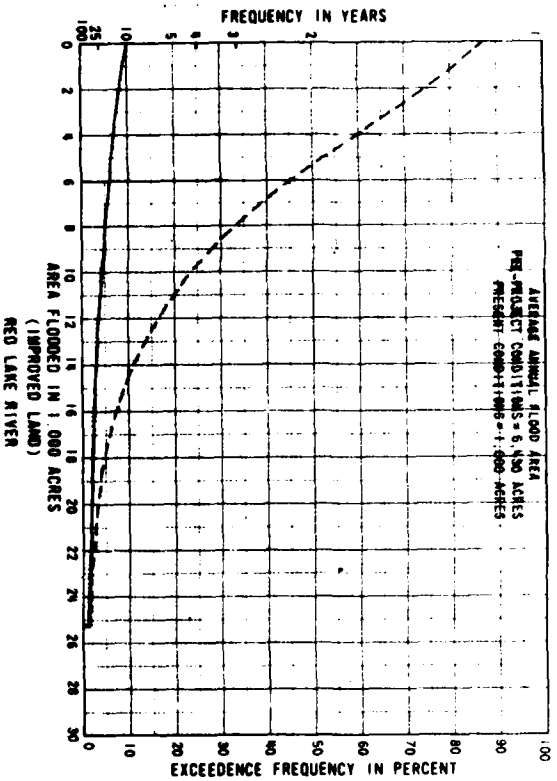
Figure 1-3. Location of Red Lake Marshes and Tributaries, and 1972 Limnological Sampling Stations

AGRICULTURAL DAMAGE - FREQUENCY





FLOODED AREA - FREQUENCY



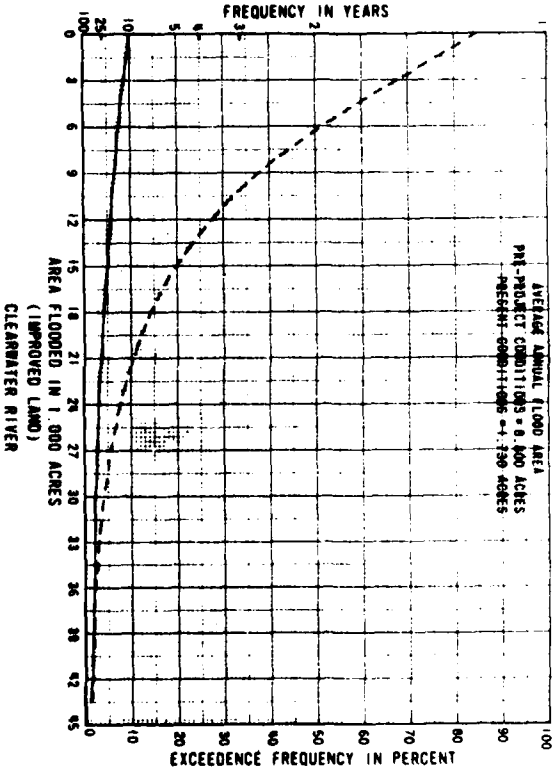
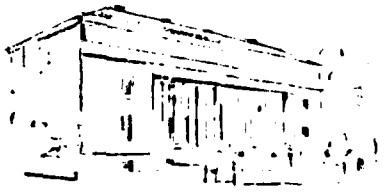


EXHIBIT 8



MINNESOTA HISTORICAL SOCIETY
690 Cedar Street, St. Paul, Minnesota 55101 • 612 296-2747

1 November 1974

Colonel Max W. Noah
District Engineer
Saint Paul District, Corps of Engineers
1210 U.S. Post Office and Custom House
Saint Paul, Minnesota 55101

Dear Colonel Noah:

RE: Draft Environmental Impact Statement
Operation and Maintenance Activities
Red Lake and Clearwater Rivers Project
Red Lake, Pennington, Clearwater, and Polk Counties
Minnesota

The above listed project proposal has been reviewed by the Survey and Planning and Archaeology sections of the Minnesota Historical Society as per your request of 11 October 1974. It is the finding of this review that there are no recorded sites of an archaeological or historical nature located within the project area. In light of the fact that no dredging is to be required, it is apparent that there will be no effect upon potential sites of an archaeological or historical nature which may be within the project area.

Respectfully,

Russell W. Fridley
Director, Minnesota Historical Society
State Historic Preservation Officer

cc: Charles W. Nelson
Historic Sites Survey and Planning
Minnesota Historical Society
Building 25, Fort Snelling
St. Paul, Minnesota 55111

Alan R. Woolworth, Chief Archaeologist
Minnesota Historical Society
Building 27, Fort Snelling
St. Paul, Minnesota 55111

RWF/fr

UNIVERSITY OF MINNESOTA
TWIN CITIES

Department of Anthropology
215 Ford Hall
Minneapolis, Minnesota 55455

December 18, 1974

Colonel Max W. Noah
District Engineer
Corps of Engineers
St. Paul District
U.S. Post Office
St. Paul, Minnesota 55101

Ref: NCSED-ER

Dear Col. Noah:

The proposed project involving operations and maintenance activities on the Red Lake and Clearwater Rivers, Minnesota, will require an intensive field archaeological survey of those sections of the two rivers where channelization or construction of control structures will occur. There is a significant prehistoric archaeological site at the source of the Red Lake River, and though the site has already been disturbed by earlier dam construction, no testing or excavation has taken place. The other areas of the upper Red Lake and Clearwater Rivers have never been archaeologically surveyed.

Sincerely,

Elden Johnson
State Archaeologist

EJ:ml
CC: Alan Woolworth

UNIVERSITY OF MINNESOTA
TWIN CITIES

Department of Anthropology
215 Ford Hall
Minneapolis, Minnesota 55455

January 8, 1975

Colonel Max W. Noah
Department of the Army
St. Paul District
Corps of Engineers
1210 U. S. Post Office & Custom House
St. Paul, Minnesota 55101

Ref: NCSED-ER

Dear Colonel Noah:

Thank you for clarifying the nature of the operation and maintenance activities on the Red Lake and Clearwater Rivers, Minnesota. Given the project plans, no archaeological survey will be required.

Sincerely,

Elden Johnson
State Archaeologist

EJ:bw

EXHIBIT 9b

Water Quality on Lower and Upper Red Lakes: 1972

	Lower Red Lake October 20, 1972		Upper Red Lake October 21, 1972		
	Mouth of Red Lake River	Redby	Cutoff Road	Shotley Brook	Waskish
Specific conductance (micromhos per cm)	295.	256.	272.	247.	240.
Alkalinity	123.	121.	128.	132.	141.
Hardness (Ca-Mg)	146.	151.	149.	137.	135.
Calcium ion	38.	39.	39.	35.	35.
Magnesium ion	12.5	13.	12.5	12.	11.5
Potassium ion	2.8	2.8	2.8	2.3	2.2
Turbidity (J.T.U.)	15.	19.	10.5	8.7	7.3
pH (pH units)	7.0	8.1	8.1	8.0	8.1
Total solids	154.	176.	174.	174.	163.
Suspended solids	14.	16.	13.	25.	18.
Nonvolatile solids	64.	86.	93.	79.	106.
Organic solids	90.	90.	81.	95.	57.
N-nitrate	0.05	0.05	0.15	0.05	0.1
N-ammonia	0.15	0.15	0.15	0.06	0.09
P-phosphate (soluble)	0.028	0.044	0.047	0.032	0.032
P-phosphate (total)	0.080	0.085	0.085	0.082	0.082
N-total Kjeldahl nitrogen	2.00	1.60	1.70	1.70	1.40
Temperature (°C)	4.	3.1	4.	2.	2.

Muskrat Pelts Taken on Red Lake Indian Reservation

Year	Pelts Sold	Year	Pelts Sold
1945	4917 or 3591	1959	
1946	9600 or 9803	1960	
1947		1961	
1948		1962	
1949		1963	
1950		1964	
1951	15,884	1965	
1952	6,959	1966	
1953	3,763	1967	
1954	1,109	1968	
1955	2,815	1969	
1956	955 (6 mos.)	1970	
1957		1971	
1958		1972	4,000

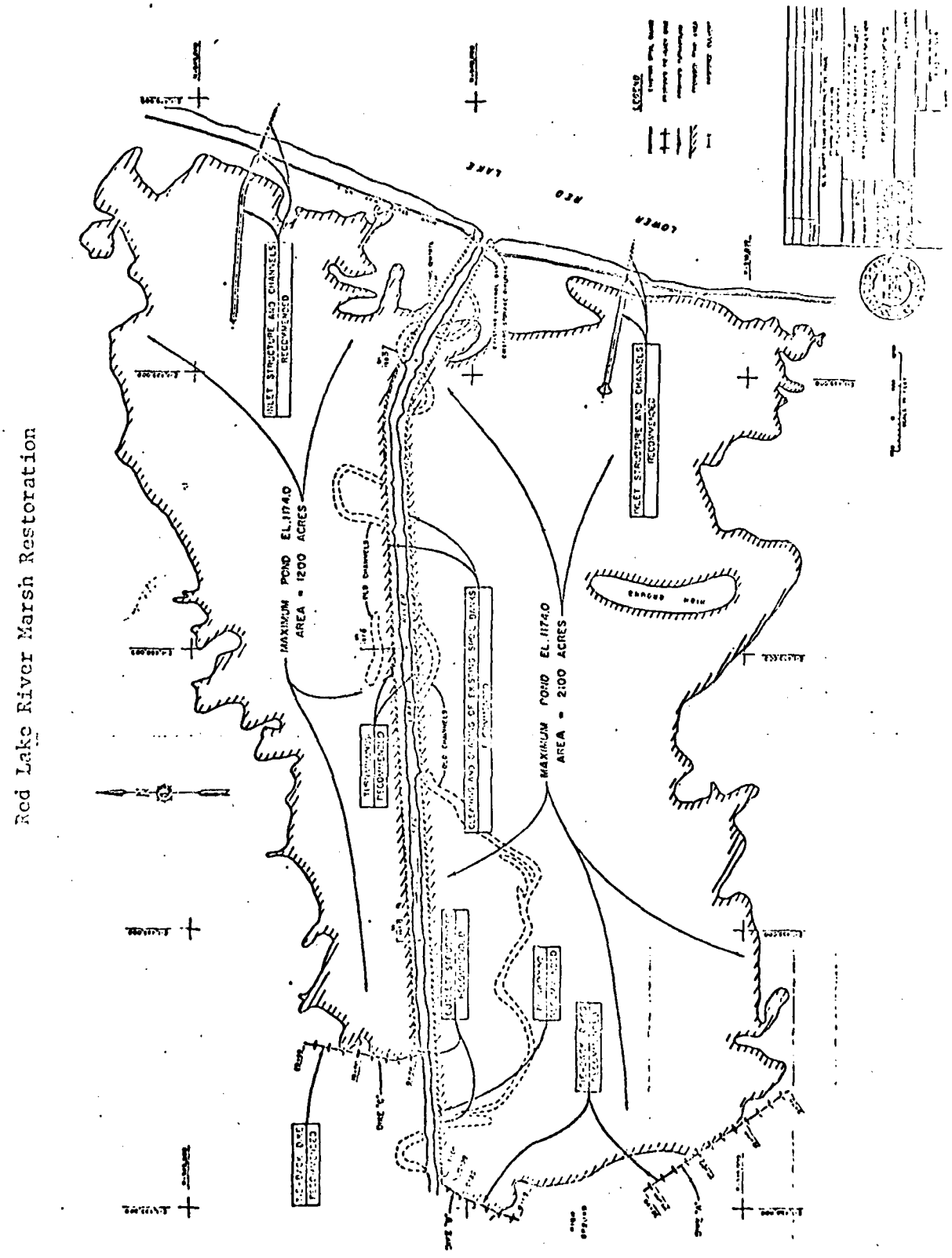

Red Lake River Marsh Restoration
MAXIMUM POND EL.1174.0
AREA = 1200 ACRES
MAXIMUM POND EL.1174.0
AREA = 2100 ACRES
INLET STRUCTURE AND CHANNELS RECOMMENDED
INLET STRUCTURE AND CHANNELS RECOMMENDED
LOWER RED LAKE

EXHIBIT 12

Ki-Wo-Say Marsh Vegetation Studies

Vegetative Studies on Ki-Wo-Say Waterfowl Development Area in Red Lake Indian Reservation, Minnesota: 1964-65

Robert E. Stewart, Leo M. Kirsch and Lewis M. Cowardin (1965) (Common names added by A. Elwell)

COMPARISON OF FREQUENCY AND AERIAL COVER OF PLANTS ON VEGETATIVE TRANSECT LINE, RED LAKE INDIAN RESERVATION, MINNESOTA

Species	Frequency per 2.25 meter sq. Quadrant 1964	Frequency per 2.25 meter sq. Quadrant 1965	Mean Percent Aerial Cover 1964	Mean Percent Aerial Cover 1965
Calamagrostis inexpansa (northern reedgrass)	98	98	67	52
Fontinalis sp. (aquatic moss) (reidentified in 1966 as *Drepanocladus* sp.)	88	98	51	59
Carex aquatilis (sedge)	79	100	20	27
Muhlenbergia racemosa (marsh muhly)	56	35	4	4
Aster junciformis (aster)	88	85	3	3
Betula pumila (swamp birch)	12	15	3	3
Phragmites communis (common reed)	10	4	1	1
Galium trifidum (small bedstraw)	37	37	1	+
Iris versicolor (wild iris)	8	8	1	+
Eleocharis palustris (spikerush)	12	0	1	0
Carex laeviculmis (sedge)	2	4	1	+
Scirpus acutus (hardstem bulrush)	2	2	1	+
Family Gramineae (unidentified grass)	2	0	1	0
Bromus ciliatus (fringed brome)	2	0	1	0
Salix candida (hoary willow)	6	6	1	+
Typha latifolia (common cattail)	13	8	1	1
Lycopus uniflorus (water horehound)	23	29	1	1
Menyanthes trifoliata (buckbean)	12	13	1	1
Salix cordata (heart-leaved willow)	13	8	+	1

Species	Frequency per 2.25 meter sq. quadrant 1964	1965	Mean Percent Aerial Cover 1964	1965
Solidago canadensis (Canadian goldenrod)	10	8	+	+
Rumex orbiculatus (great water dock)	8	15	+	+
Veronica scutellata (marsh speedwell)	8	21	+	1
Cirsium muticum (swamp thistle)	6	6	+	1
Pedicularis lanceolata (lousewort)	6	13	+	+
Helenium autumnale (sneezeweed)	6	0	+	0
Solidago graminifolia (narrow-leaved goldenrod)	6	6	+	+
Gentiana procera (small fringed gentian)	6	2	+	+
Lycopus americanus (water horehound)	4	6	+	+
Mentha arvensis (wild mint)	4	4	+	+
Asclepias incarnata (swamp milkweed)	4	0	+	0
Agrostis scabra (ticklegrass)	4	10	+	+
Eupatorium maculatum (Joe-pye weed)	2	4	+	+
Scutellaria epilobiifolia (marsh skullcap)	2	13	+	+
Sium suave (water parsnip)	2	0	+	0
Rubus acaulis (dwarf raspberry)	2	4	+	+
Gerardia tenuifolia (slender gerardia)	2	0	+	0
Triglochin maritima (arrowgrass)	2	13	+	+
Parnassia palustris (bog star)	-	4	+	+
Salix interior (sandbar willow)	2	4	+	+
Campanula aparinoides (marsh bellflower)	0	54	0	2
Calamagrostis canadensis (Canadian reedgrass)	0	8	0	+
Dryopteris thelypteris	0	4	0	+
Cicuta bulbifera (bulb-bearing water hemlock)	0	6	0	+
Lysimachia thyrsiflora (loosestrife)	0	31	0	1
Poa palustris (blue grass)	0	4	0	+
Carex limosa (sedge)	0	2	0	+
Carex (sedge)	0	2	0	1
Potentilla palustris (cinquéfoil)	0	2	0	+
Populus balsamifera (balsam poplar)	0	2	0	+
Salix rigida (rigid willow)	0	4	0	+
Potamogeton gramineus (variable-leafed pondweed)	0	2	0	+

Cover and frequency percentage values are taken to the nearest whole number. A plus sign (+) for cover indicates a percentage value less than 0.5.

Vegetative Studies on Ki-Wo-Say Waterfowl Development Area in Red Lake Indian Reservation, Minnesota

Robert E. Stewart, Leo M. Kirsch and Lewis M. Cowardin (1965) (Common names added by A. Elwell)

DOMINANT PLANT SPECIES IN AREA ADJACENT TO POTHOLES AT RED LAKE INDIAN RESERVATION, MINNESOTA

	Pothole Number				
Species	1	2	3	4	7
Calamagrostis inexpansa (northern reedgrass)	x	x	x	x	x
Carex aquatilis (sedge)	x				
Muhlenbergia racemosa (marsh muhly)	x	x	x	x	x
Fontinalis sp. (aquatic moss) (reidentified in 1966 as *Drepanocladus* sp.)	x	x	x		
Aster junciformis (aster)	x		x	x	x
Betula pumilia (swamp birch)	x		x		
Phragmites communis (common reed)				x	
Typha latifolia (cattail)				x	
Cicuta bulbifera (bulb-bearing water hemlock)					
Agrostis scabra (ticklegrass)		x	x		
Veronica scutellata (marsh speedwell)		x	x		
Menyanthes trifoliata (buckbean)		x	x		x
Gentiana procera (small fringed gentian)		x			
Equisetum fluviatile (horsetail)		x	x		
Sarracenia purpurea (pitcher plant)					
Parnassia palustris (bog star)					
Salix discolor (pussy willow)	x				
Salix cordata (heart-leaved willow)	x				
Salix rigida (rigid willow)	x				
Carex atherodes (sedge)	x				
Potamogeton gramineus (variable-leafed pondweed)			x		
Utricularia (bladderwort)			x		x
Salix candida (hoary willow)	x				
Solidago canadensis (Canadian goldenrod)			x		

Methods Used in Limnological Investigation

In an attempt to gain first-hand familiarity with the aquatic systems of the two lakes and to collect samples during the few remaining days of the ice-free field season, two sampling trips were made to the area. The weather had been influenced by a cold weather front during the week prior to sampling and small chunks of ice were observed floating on Upper Red Lake. The first field trip was made to Lower Red Lake on October 20, 1972. On this date basic limnological data and samples of phytoplankton and benthic invertebrates were collected at three sampling stations: 1) at the west end of Lower Red Lake near the outlet structure at a distance of about 400 yards out from shore, 2) in Redby at a distance of approximately 3000 feet off shore from the Red Lake Fisheries Association Building, and 3) at the "cut-off road" on the east side of Lower Red Lake about one mile north of the mouth of the Black Duck River. We had also intended to take one additional set of samples at Ponemah, but the presence of a southeast wind which produced surface waves of 1.5 feet in amplitude made boat launching and sampling unsafe.

A second field trip was made to Upper Red Lake on October 21, 1972. On this date an identical set of samples was collected at two sampling sites. The first location was at a site about 2000 feet directly in front of Roger's Shotley Brook Resort. The second was slightly south of Waskish at a site about 3000 feet directly off the fire tower and south of the mouth of the Tamarack River. In the Lower Red Lake the sampling stations were selected to coincide with locations for which base line data existed which had been sampled by Kopp (1960). The location of the sampling stations on Upper Red Lake was determined by ease of access and the desire to collect near important spawning areas. Thus, no samples were collected along the north shore of Upper Red Lake, because of the distances that would have had to be traveled to reach these remote locations.

On both dates an identical set of limnological samples was collected, which included determinations of air and water temperature, light penetration,

plankton samples, and samples of benthic invertebrates. Measurements of air and water temperatures were made with a Yellow Springs Instrument Company thermometer Model 43 TE, temperature range from 20 to 40°C. Light penetration was measured with an eight-inch black and white Secchi Disk. Two 1200 ml samples of lake water were collected with a Kemmerer water bottle. Part of each sample was subjected to a dissolved oxygen determination which was made with a Hach Model OX2-P Dissolved Oxygen Test Kit. The remainder of each water sample was divided into two parts, one of which was placed in a one-liter plastic container and preserved with mercuric chloride. The other one-liter sample was preserved with chloroform and saved for further chemical analysis. The results of these analyses by Lundberg will be included in another section of this report.

Duplicate horizontal tow surface samples of phytoplankton were collected with a Wisconsin Plankton Net with No. 20 silk bolting cloth. The plankton samples were then placed in baby food jars and preserved in 10-percent formalin. In the laboratory the samples were identified by use of taxonomic keys including Prescott (1962) and Smith (1950).

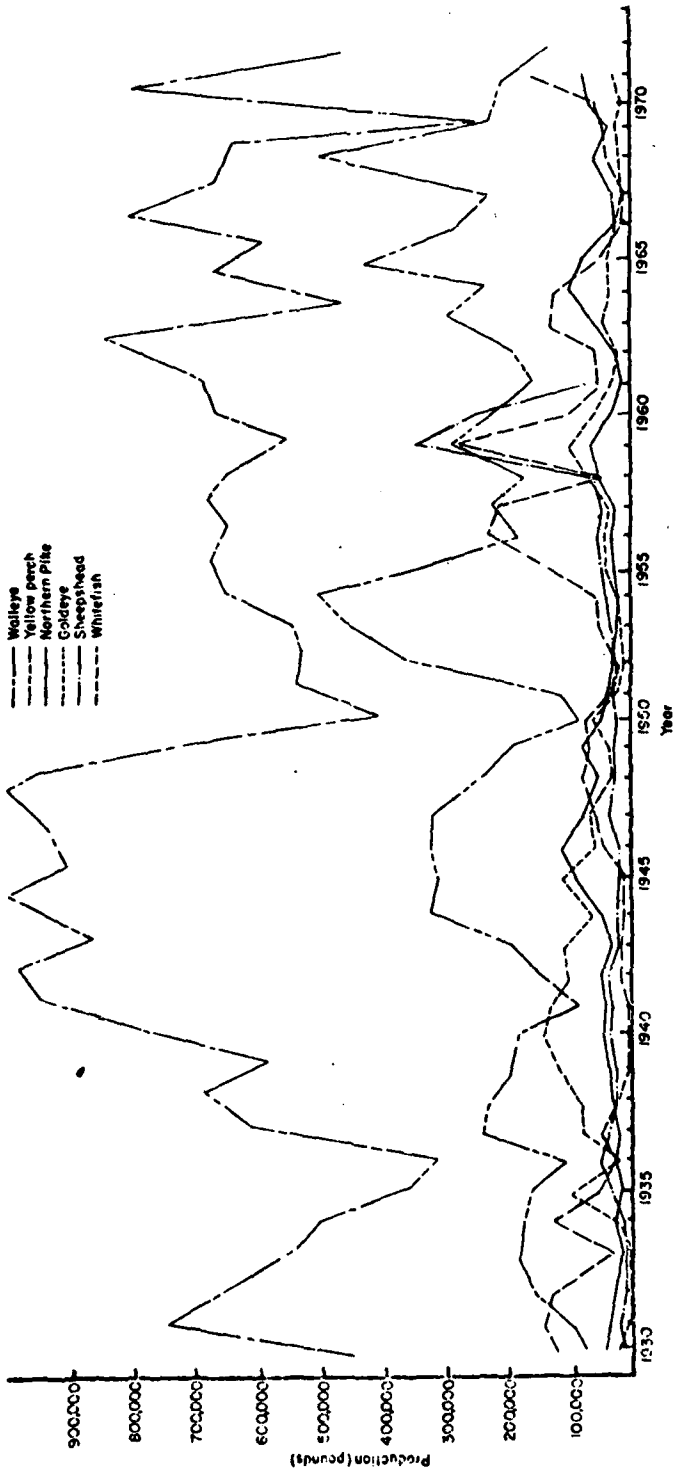
Two samples of benthic invertebrates were taken with a Petersen dredge at each station. These were processed in the field and placed in whirl-pak bags. The bottom samples were preserved in 10-percent formalin. In the laboratory the samples were sorted qualitatively and identified by use of invertebrate taxonomic keys including Eddy and Hodson (1961) and Pennak (1953).

The data on commercial fisheries catch statistics which are used in this report are taken from the literature, particularly from the reports of Smith and his co-workers.

Water Quality of Lower Red Lake: 1932 to 1972

	1932	May 1962	Oct. 1972
Specific conductances in μmhos per cm at 25°C	Not taken	283.0	256
Total hardness	139.0	146.0 ($CaCO_3$)	150 (Ca-Mg)
Ca^{++}	31.0	34.0	39.0
Mg^{++}	15.0	15.0	13
Na^{+}	23.0	3.2	Not taken
K^{+}	9.0	2.0	2.8
$CO_3^{=}$	14.0	0.6	Not taken
HCO_3^{-}	151.0	171.0	121.0
$SO_4^{=}$	3.0	12.0	Not taken
Cl^{-}	1.8	0.2	Not taken
pH	Not taken	7.6	8.1
Suspended matter	12.0	Not taken	16.0
Volatile organic matter	72.0	Not taken	90.0
Total dissolved solids	200.0	180.0	160.0
NO_3^{-}	24.0 (5.4-N)	2.8 (0.63-N)	(0.05-N)
H_3PO_4	1.4 (0.45-P)	Not taken	(0.085-P)
Fe	Not taken	0.02	Not taken
SiO_2	3.0	5.2	Not taken
Al	1.1 (Allison 1932)	Not Taken (Maderak 1963)	Not Taken (Lundberg 1972)

EXHIBIT 14

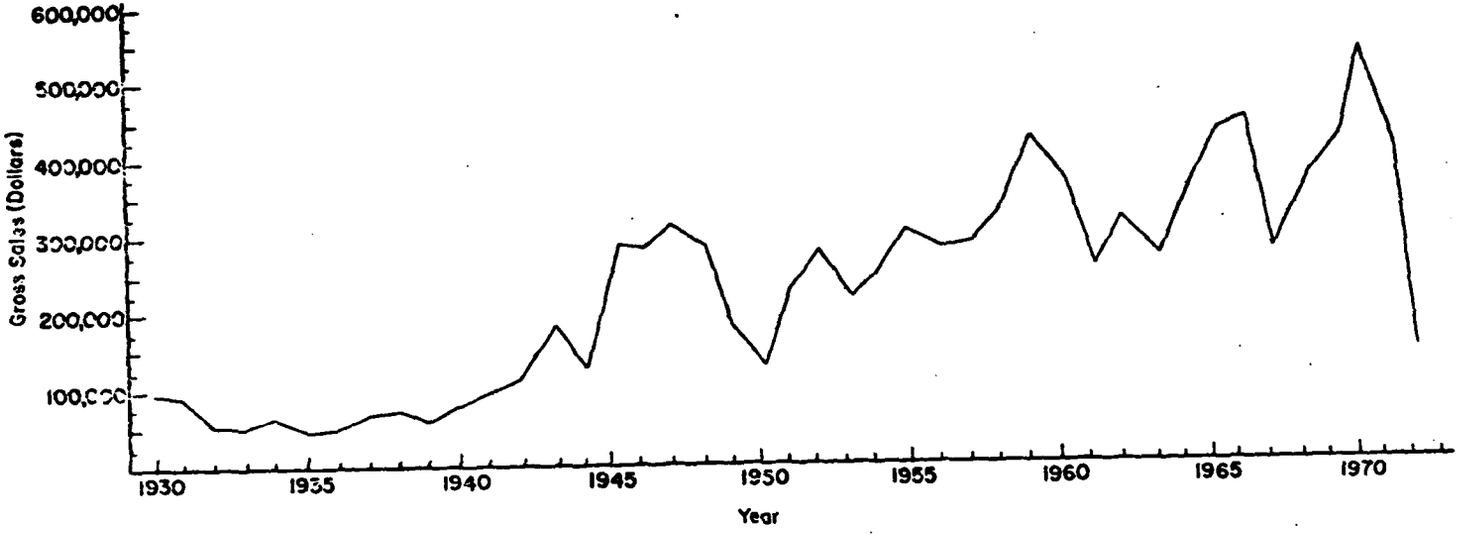


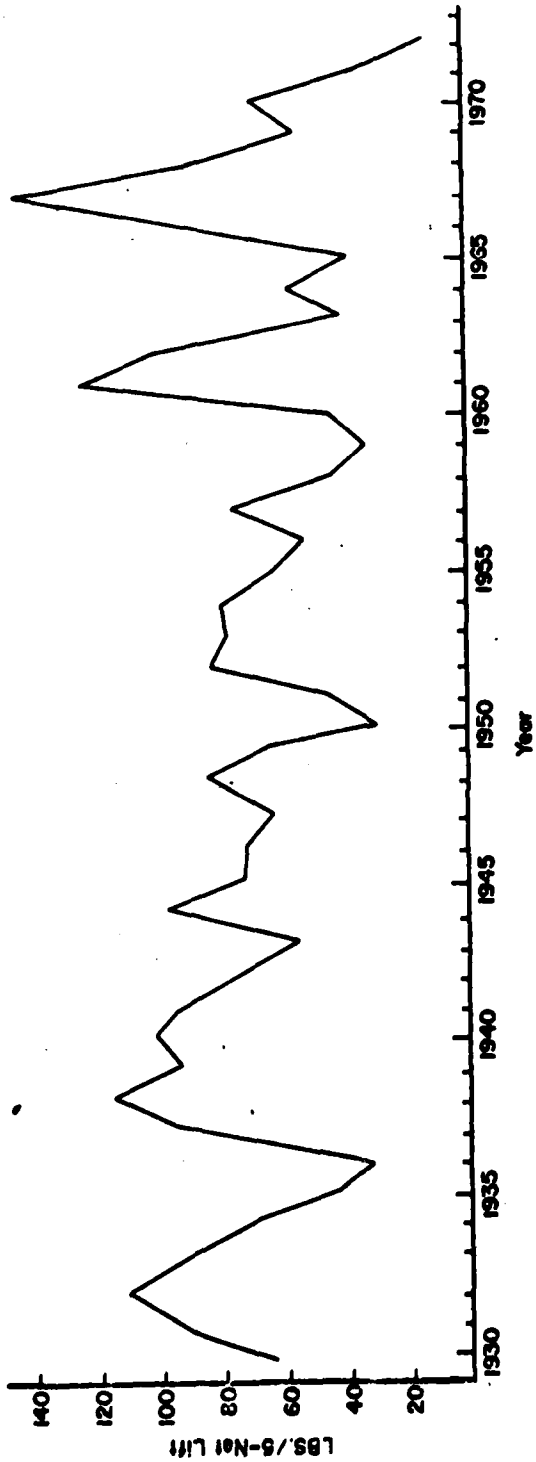
Fish Production (in pounds) of Commercially Important Species of Fish in the Red Lakes, 1930 to 1972

EXHIBIT 15

EXHIBIT 16

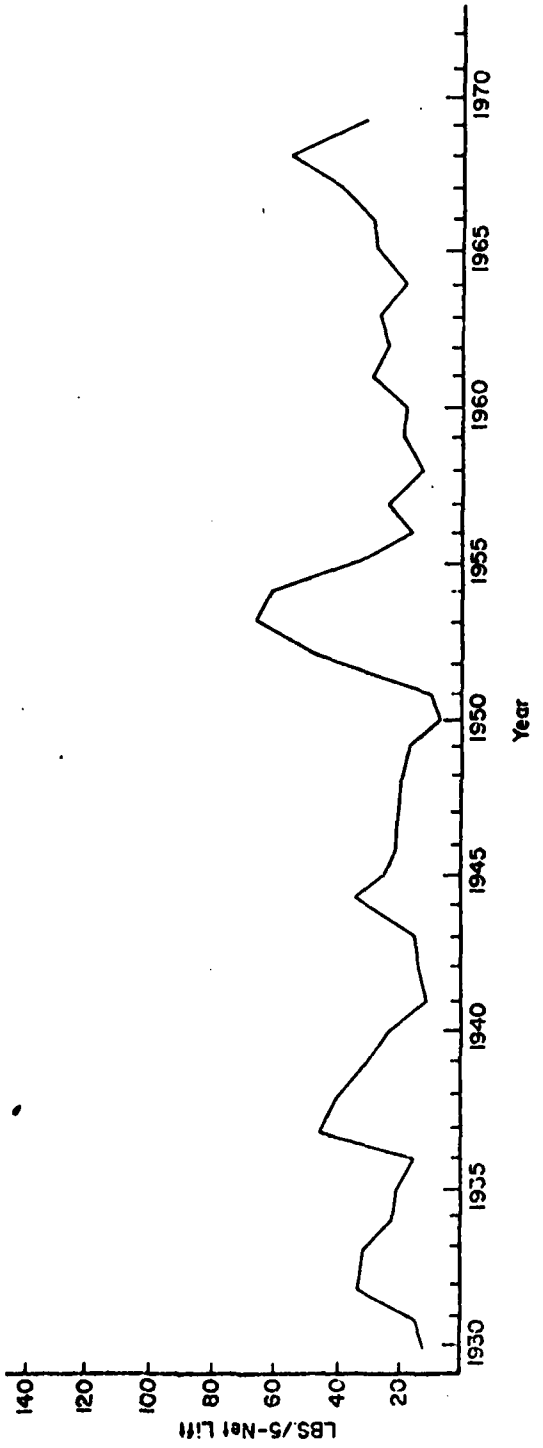
Annual Gross Sales (in dollars) for the Harvest of All Commercial Species by the Red Lake Fisheries Association, 1930 to 1970





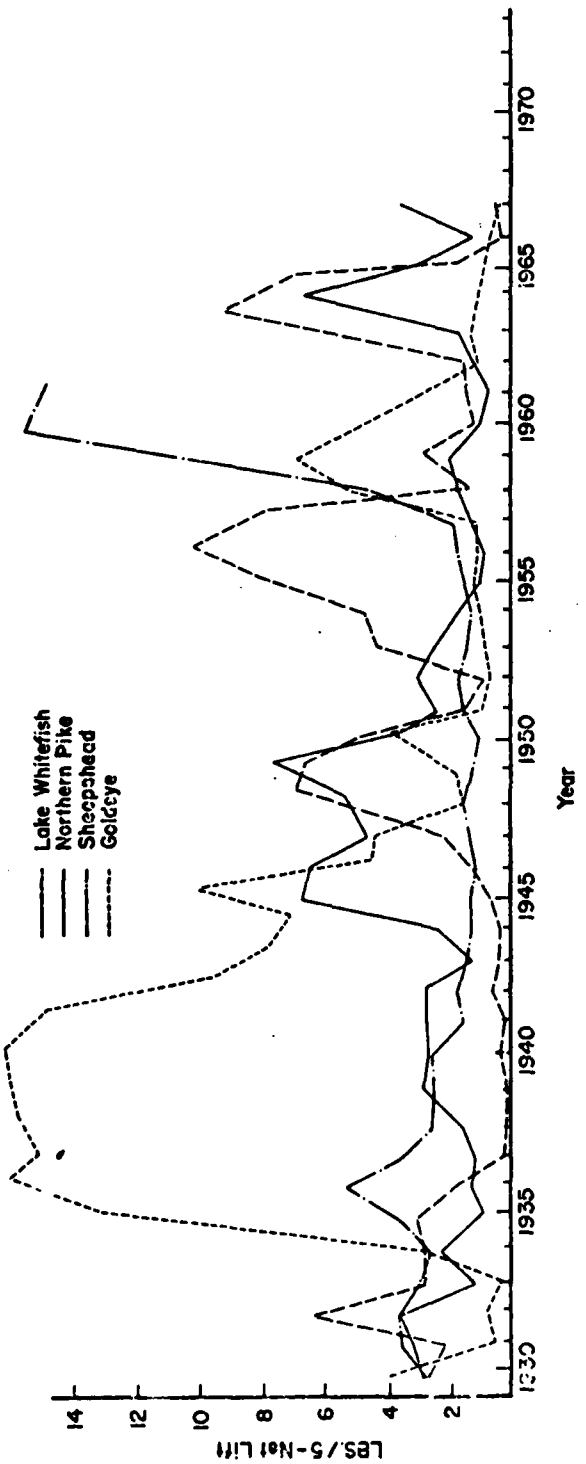
Catch per Unit Effort. (CPE) for Total Walleyes in Red Lake, 1930 to 1972

EXHIBIT 17



Catch per Unit Effort (CPE) for Yellow Perch in Red Lake, 1930 to 1970

EXHIBIT 18



Catch per Unit Effort (CPE) for Other Commercial Species Including the Lake Whitefish, Northern Pike, Sheepshead, and Goldeye in Red Lakes, 1930 to 1967

Percent of Average Annual Catch of Commercial Fish from the Red Lakes, Minnesota, 1959-1970

	Per 100 lbs Caught	
	1959	1970
Walleye, Stizostedion vitreum vitreum	63 lb	56 lb
Yellow perch, Perca flavescens	20 lb	24 lb
Whitefish, Coregonus clupeaformis		9 lb
Northern pike, Esox lucius	17 lb	3 lb
Goldeye, Amphiodon alosoides		3 lb
Others (Sheepshead, Aplodinotus grunniens Black bullhead, Ictalurus melas)		5 lb

Sources: Grosslein and Smith (1959) and Peterka and Smith (1970).

Animals Presently Known To Be on the
Red Lake Indian Reservation*

	Resident 1971	Seasonal 1971	Removed 1971
Bear	100	10	15
Elk	--	10	3
Deer	6,000	--	--
Moose	60	--	--
Ducks (unnamed)	5,000	350,000	5,000
Geese (unnamed)	3	5,000	200
Pheasant	--	15	--
Grouse	600	--	100
Partridge	10,000	--	3,000
Dove	650	--	--
Beaver	550	--	175
Muskrat	20,000	--	4,000
Mink	300	--	50
Otter	80	--	6
Raccoon	1,000	--	35
Weasel	600	--	50
Skunk	1,000	--	35
Fox	400	--	75
Timber wolf	30	--	6
Coyote	100	--	20

*Jorgenson, 1971.

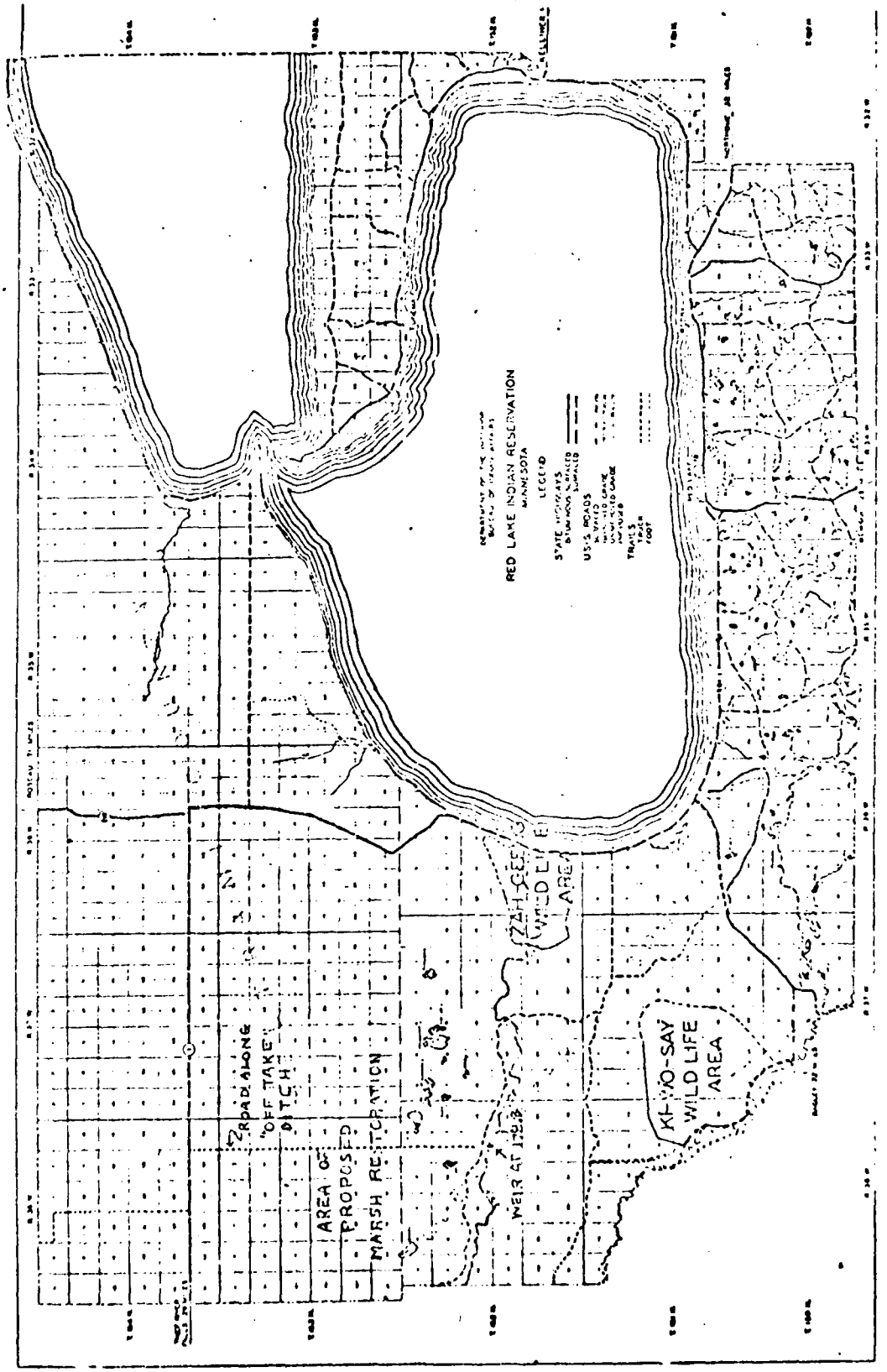

RED LAKE INDIAN RESERVATION
MINNESOTA
LEGEND
ROAD ALONG "OFF TAKE" DITCH
AREA OF PROPOSED MARSH RESTORATION
WEIR AT
KHO-SAY WILD LIFE AREA

EXHIBIT 22

Effect of Wild Rice Paddies on Upper Red Lake Water Quality

	Creek Before Paddies	Creek Leaving Paddies
Turbidity (T.F.U.)	0.9	0.76
Total solids	251.0	280.0
Suspended solids	21.0	14.0
Organic solids	138.0	154.0
Nitrate nitrogen N	0.1	13.0
Ammonia nitrogen N	1.31	1.50
Total Kjeldahl nitrogen N	1.71	2.49
Soluble phosphorus P	0.023	0.070
Total phosphorus P	0.038	0.098
Alkalinity	166.0	181.0
Hardness (Ca-Mg)	177.0	199.0
Calcium ion	47.8	53.0
Magnesium ion	13.9	16.3
Potassium ion	0.28	0.58
Dissolved oxygen	8.8	9.8
pH (pH units)	7.9	7.5
Temperature (^{o}C)	19.8	20.7

Average concentration for 1971 growing season as ppm.

EXHIBIT 23

Water Quality on Lower and Upper Red Lakes: 1972

	Lower Red Lake October 20, 1972		Upper Red Lake October 21, 1972		
	Mouth of Red Lake River	Redby	Cutoff Road	Shotley Brook	Waskish
Specific conductance (micromhos per cm)	295.	256.	272.	247.	240.
Alkalinity	123.	121.	128.	132.	141.
Hardness (Ca-Mg)	146.	151.	149.	137.	135.
Calcium ion	38.	39.	39.	35.	35.
Magnesium ion	12.5	13.	12.5	12.	11.5
Potassium ion	2.8	2.8	2.8	2.3	2.2
Turbidity (J.T.U.)	15.	19.	10.5	8.7	7.3
pH (pH units)	7.0	8.1	8.1	8.0	8.1
Total solids	154.	176.	174.	174.	163.
Suspended solids	14.	16.	13.	25.	18.
Nonvolatile solids	64.	86.	93.	79.	106.
Organic solids	90.	90.	81.	95.	57.
N-nitrate	0.05	0.05	0.15	0.05	0.1
N-ammonia	0.15	0.15	0.15	0.06	0.09
P-phosphate (soluble)	0.028	0.044	0.047	0.032	0.032
P-phosphate (total)	0.080	0.085	0.085	0.082	0.082
N-total Kjeldahl nitrogen	2.00	1.60	1.70	1.70	1.40
Temperature (°C)	4.	3.5	4.	2.	2.

Limnological Data from Upper and Lower Red Lake (Collected on Octer 20 and 21, 1972)

	Lower Red Lake October 20, 1972			Upper Red Lake October 21, 1972	
	Red Lake River	Redby	Cutoff Road	Shotley Brook	Waskish
Air temperature (°C)	5.0	5.0	5.0	4.0	7.0
Water temperature (°C)	4.0	3.5	4.0	2.0	2.0
Surface	4.0	3.5	4.0	2.0	2.0
1 m	4.0	3.5	4.0	2.0	2.0
2 m	4.0	3.5		2.0	2.0
3 m				2.0	
Mean Secchi disk (m)	0.77	0.75	0.7	0.6	0.55
Dissolved oxygen ppm					
Surface	14.0	13.0	12.0	14.0	14.0
Bottom	13.0	11.0	12.0	15.0	sample lost

Species Composition of Net Phytoplankton Collected in the Red Lakes On October 20 and 21, 1972. [The X in the field of the Table Refers to Organisms Collected in the Present Study. The * refers to Organisms Reported by Knapp (1960).]

Scientific Name	Lower Red Lake October 20, 1972 Red Lake River (outlet)	Redby	Cut Off Road	Upper Red Lake October 21, 1972 Shotley Brook	Waskish
Blue-Green Algae					
Chroococcus limneticus	X	X	X	X	X
Microcystis aeruginosa	X	X	X	X	X*
Anabaena spiroides var. *crassa*	X	X		X	
Symploca muscorum		X		X	
Spirulina nordstedii				X	X
Anabaena flos-aquae			X		X
Coelosphaerium naegelianum	X				
Green Algae					
Desmidiaceae					
Staurastrum natator	X*	X	X	X*	X
Staurastrum sp.	X*			X	
Arthrodesmus sp.				X	
Pediastrum boryanum	X*	X*	X*	X	X*
P. duplex var. *clathratum*	X*	X*	X*	X*	
P. duplex var. *cohaerens*	X*	X			
Coelastrum cambricum		X			
Gloeocystis major		X			
Oedogonium sp.				X	
P. duplex var. *reticulatum*			X		
Crucigenia rectangularis			X		
Coelastrum microporum			X		
Scenedesmus quadricauda			X		
Diatoms					
Fragilaria capucina	X	X	X	X	X
Fragilaria virescens	X	X		X	X
Asterionella ormondensis	X*	X*	X*	X*	X*
Melosira italica	X*	X*	X*	X*	X*
Knapp's Station	#9	#1	#7		

Species Composition of Net Phytoplankton Collected in the Red Lakes
On October 20 and 21, 1972 (Continued)

Scientific Name	Red Lake River (outlet)	Redby	Cut Off Road	Shotley Brook	Waskish
Diatoms (Continued)					
Asterionella formosa	X*	X*	X*	X*	X*
Stephanodiscus niagarae	X*	X*	X*		
Tabellaria fenestrata	X*	X*	X*	X*	X*
Synedra acus	X	X	X		X
Nitzschia sigmoidea	X		X	X	
Cyclotella meneghiniana		X			
Surirella linearis			X		
Rhizosolenia eriensis					X
Amphora ovalis					X*
Synedra ulna				X	X
Knapp's Station	# 9	# 1	# 7		

Species Composition of Benthic Invertebrates Collected with a Petersen Dredge in the Red Lakes on October 20 and 21, 1972

Scientific Name	Red Lake River	Redby	Cut Off Road	Shotley Brook	Waskish	Common Name
Cladocera					X	Water fleas
Pisidium sp.	X	X			X	Fingernail clam
Sphaerium sp.		X				Fingernail clam
Amnicola sp.	X	X				Snail
Lymnaea stagnalis	X					Snail
Physa sp.	X					Snail
Valvata tricarinata	X					Snail
Promenetus exacuatus	X					Snail
Helobdella stagnalis	X	X				Leech
Dina parva	X					Leech
Turbellaria	X					Flatworms
Planariidae,	X					Flatworm - planaria
Oligochaeta	X				X	Aquatic annalids
Ephemera sp.					X	Burrowing mayfly
Hexagenia sp.					X	Burrowing mayfly
Caenis sp.					X	Bottom sprawler mayfly
Hydropsychidae	X			X		Net-spinning caddisfly
Molannidae	X	X				Caddisfly
Philopotamidae	X					Silken tube-spinners, Finger net caddisfly
Psychomyiidae	X					Tube-making, trumpet net caddisfly
Pelopiinae (= Tanypodinae)		X			X	Midge
Tendipedinae	X	X	X	X	X	Midge
Ceratopogonidae			X	X	X	Biting midge
Elmidae					X	Riffle beetles
Gammaridae				X	X	Scud
Hyalella azteca	X	X	X			Scud
Ostracoda	X					Seed shrimp
Eubranchiopoda					X	Clam shrimp

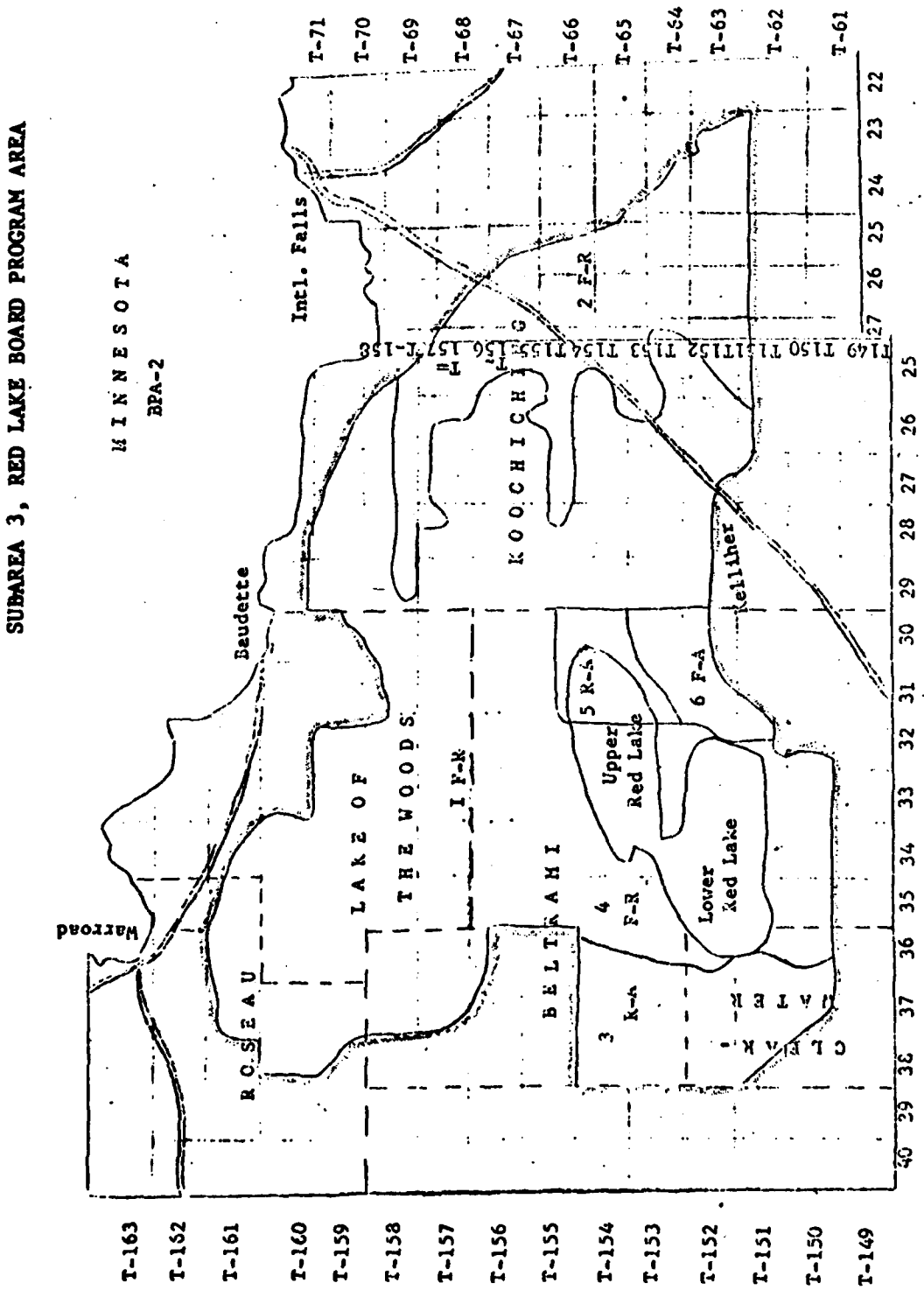
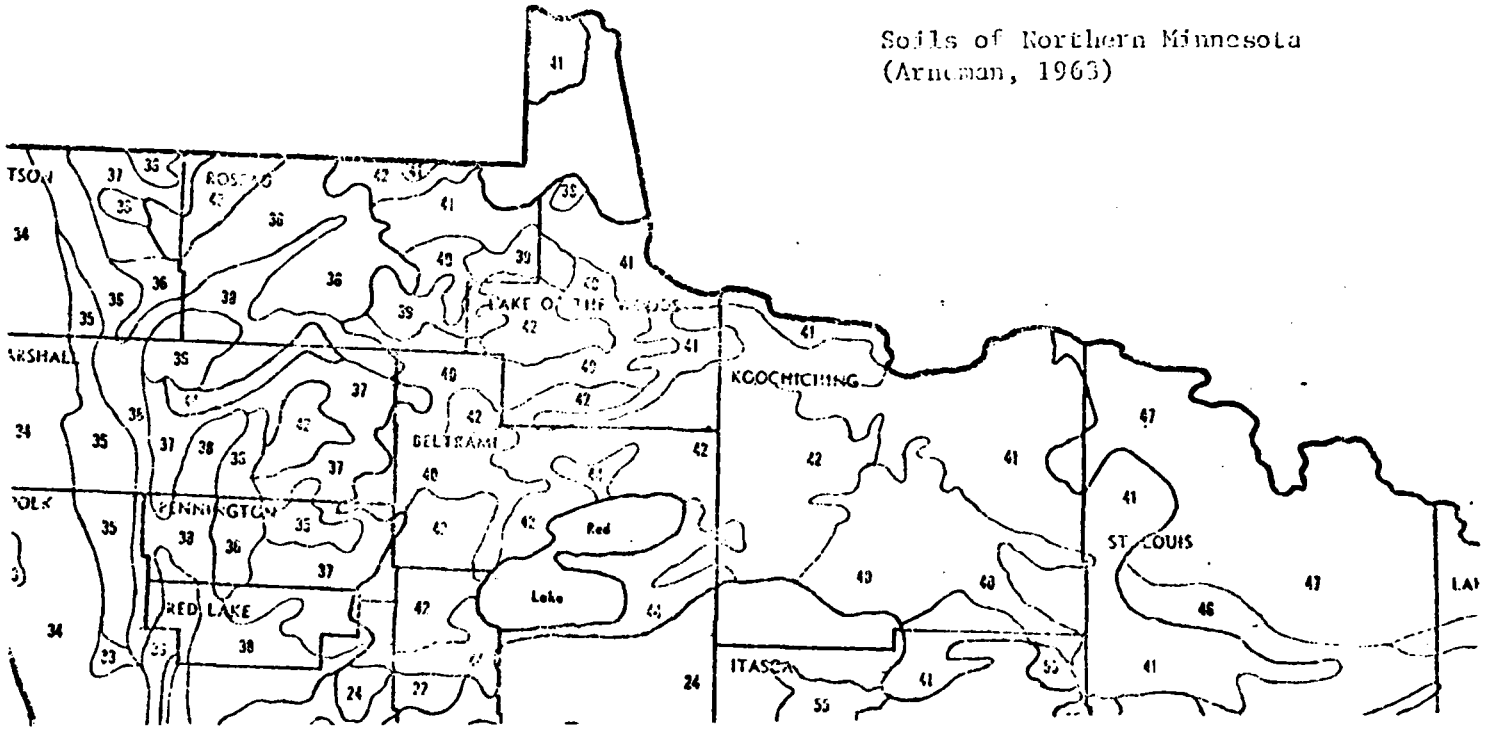

SUBAREA 3, RED LAKE BOARD PROGRAM AREA
MINNESOTA
BPA-2
Int'l. Falls
Baudette
Warroad
Kelliher
KOOCHICHING
LAKE OF THE WOODS
ROSEAU
BELTRAMI
Upper Red Lake
Lower Red Lake
1 F-R
2 F-R
3 F-R
4 F-R
5 F-R
6 F-A
T-71
T-70
T-69
T-68
T-67
T-66
T-65
T-64
T-63
T-62
T-61
T-163
T-162
T-161
T-160
T-159
T-158
T-157
T-156
T-155
T-154
T-153
T-152
T-151
T-150
T-149

EXHIBIT 28

Soils of Northern Minnesota
(Arneman, 1963)



Medium-textured forest soils of North-Central Minnesota

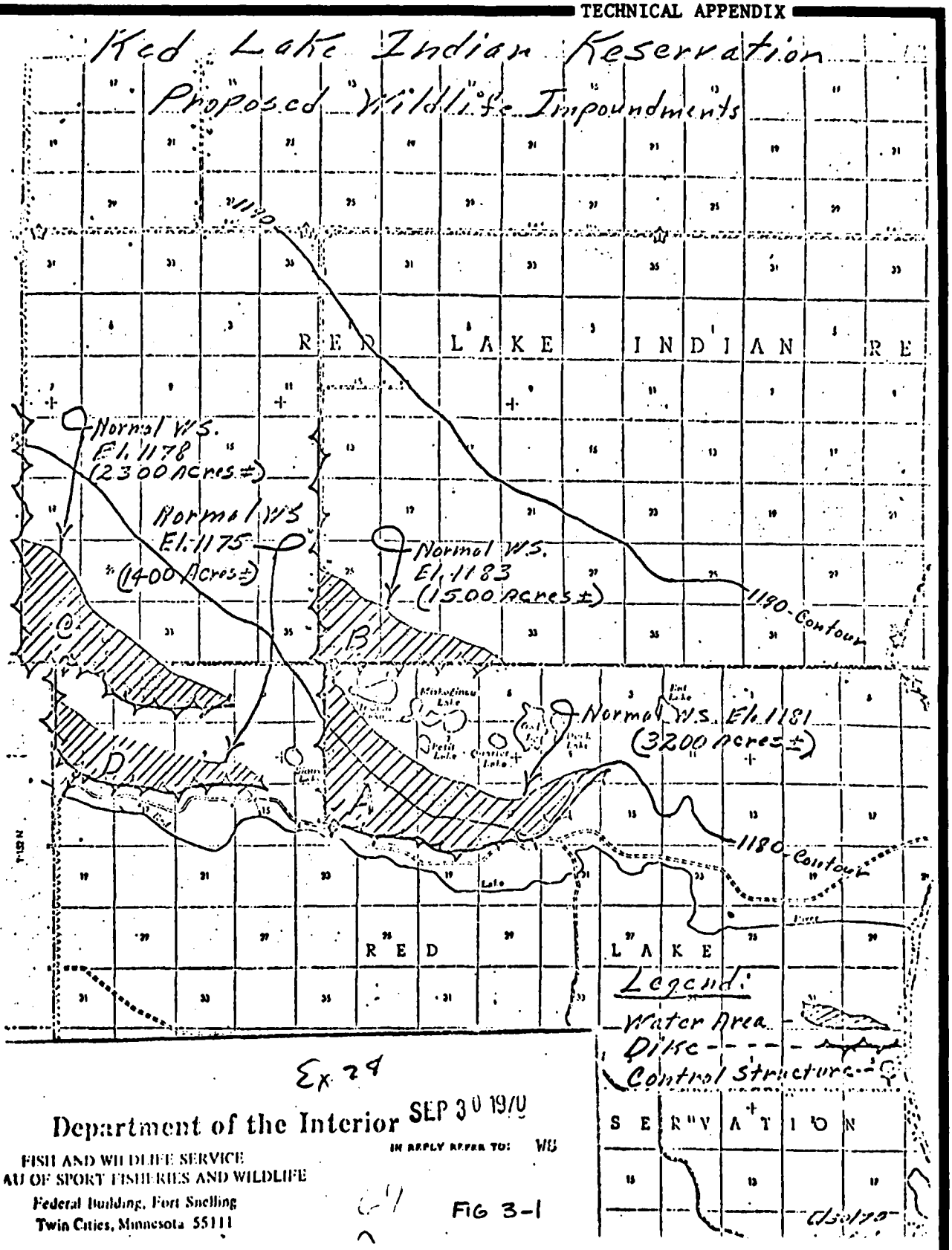
24 Nebish-Rockwood

Coarse to fine textured forest soils and organic soils of glacial lake plains

40 Hiwood organic soil

42 Peat, organic soil of glacial lake plain

44 Redby-Peat



Ex 24

Department of the Interior SEP 30 1970

IN REPLY REFER TO: WB

FISH AND WILDLIFE SERVICE
BU OF SPORT FISHERIES AND WILDLIFE
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

FIG 3-1

C
O
P
Y

Oct. 22, 1947

PROCEEDINGS OF THE GENERAL COUNCIL OF THE RED LAKE BAND OF CHIPPEWA INDIANS

Resolution No. 1 Serial No. 366

WHEREAS, the general council of the Red Lake Band of Chippewa Indians, Red Lake Indian Reservation, Red Lake, Minnesota, has been approached by the United States Engineers office of the Department of the Army, whose address is 1217 U. S. Post Office and Custom House, St. Paul 1, Minnesota, to agree or object to the proposed flood control and drainage improvements authorized for the construction, operation and maintenance under section 10 of the Flood Control Act approved December 22, 1944; and

WHEREAS, Colonel W. K. Wilson, Jr., District Engineer, Corps of Engineers, of St. Paul, Minnesota, held a conference on October 22d, 1947, with the general council of the Red Lake Band of Chippewa Indians,

NOW THEREFORE, BE, AND IT IS HEREBY RESOLVED that the general council of the Red Lake Band of Chippewa Indians does not offer any objection to the proposed flood control works that may be made within the Red Lake Indian Reservation and does hereby permit the Department of the Army to carry out the necessary work on tribal lands and deposit spoil thereon, does hereby further permit the Red Lake Drainage and Conservancy District to maintain the works on tribal lands within said reservation under supervision of the Department of the Army and hereby authorizes the Commissioner of Indian Affairs to issue the necessary permits to carry this resolution into effect, PROVIDED;

1. No costs of construction shall be charged to the Red Lake Band of Chippewa Indians.

2. No costs of repair or maintenance shall be charged to the Red Lake Band of Chippewa Indians.

3. Control of the lake levels to be vested in the Department of the Army.

4. The tribe shall not be liable for any damages that may be caused by such improvements.

5. The tribe reserves the right to present a claim against the United States for any damages that may result from the construction, maintenance or operation of this project.

6. Members of the Red Lake Band of Chippewa Indians shall be employed on any work within the Red Lake Indian Reservation wherever possible.

We, the undersigned, do hereby certify this to be an exact copy of resolution number 1 in council proceedings dated October 22, 1947.

Witnesses to mark:

/s/Peter Graves

/s/Rose Graves

Bazil Lawrence (his mark)
Bazil Lawrence
Chairman

/s/Peter Graves
Peter Graves

Red Lake, Minnesota
October 24, 1947

SEAL

C
O
P
Y

GENERAL COUNCIL OF THE
RED LAKE BAND OF CHIPPEWA INDIANS

Red Lake Indian Reservation
Red Lake, Minnesota

October 28, 1948

PROCEEDINGS OF THE GENERAL COUNCIL OF THE RED LAKE BAND
OF CHIPPEWA INDIANS

Resolution No. 5 Serial No. 425

WHEREAS, in resolution number 1, serial number 366, dated October 22, 1947, the council approved the improvement of the Red Lake and Clearwater River channels for flood control purposes, and

WHEREAS, the question now arises as to whether the adjacent lands should be subject to drainage or be left as much as possible as they are at the present for the conservation of waters for propagation of wildlife on the reservation;

NOW THEREFORE, BE, AND IT IS HEREBY RESOLVED that the area adjacent to the Red Lake and Clearwater River channels on the reservation be kept in its present flooded state as recommended by the Fish and Wildlife Director, Minneapolis, Minnesota.

IT IS FURTHER RESOLVED that the established water level of 1174.0 from May 1 to June 15, annually, be maintained, and the recommendations of the Fish and Wildlife Director as to further study for the development of marshes, streams, and ponds for fur production and waterfowl are to be followed;

IT IS FURTHER RESOLVED that the superintendent of the Red Lake Indian Agency is requested to look after the interests of the Red Lake Band of Chippewa Indians in the flood control project and to advise the Red Lake Indian Council that the requirements are properly followed within the Red Lake Indian Reservation.

Unanimously approved.

We, the undersigned, do hereby certify this to be an exact copy of resolution number 5 in council proceedings dated October 28, 1948.

Witnesses to mark:

/s/Peter Graves
Peter Graves

Bazil Lawrence (his mark)
Bazil Lawrence

/s/Rose Graves

/s/Peter Graves
Peter Graves
Secretary

Red Lake, Minnesota
Nov. 1, 1948

SEAL

The third resolution - adopted 17 April 1949

"***WHEREAS, in Resolution number 1, Serial number 366, dated October 22, 1947, the Council approved the improvement of the Red Lake and Clearwater River channels for flood control purposes, and

"WHEREAS, the question now arises as to whether the adjacent lands should be subject to drainage or be left as much as possible as they are at the present for the conservation of waters for propagation of wild life on the Reservation;

"NOW THEREFORE, BE, AND IT IS HEREBY RESOLVED that the area adjacent to the Red Lake River channel on the Reservation be kept in its present flooded state as recommended by the Fish and Wildlife Director, Minneapolis, Minnesota, with the following exceptions.

"(a) The channel of Red Lake River shall be improved for a distance of about 3-1/2 miles downstream from the dam at Lower Red Lake to permit greater discharge from the lakes when they are above the normal level of 1174.0.

"(b) the channel of Red Lake River shall be improved from the western boundary of the Reservation to a point about 4-1/2 miles east to facilitate drainage from the existing lateral ditch.

"(c) a control shall be constructed in the channel of Red Lake River upstream from said lateral ditch, to assist in flooding the area upstream;

"IT IS FURTHER RESOLVED that the water levels on the Red Lakes be held as closely as practicable to the established level of 1174.0 from May 1, to June 15, annually;

"IT IS FURTHER RESOLVED that any damages that may be caused by excavations within the Red Lake Indian Reservation must be properly estimated and the amount of damage must be paid to the Red Lake Band of Chippewa Indians;***"

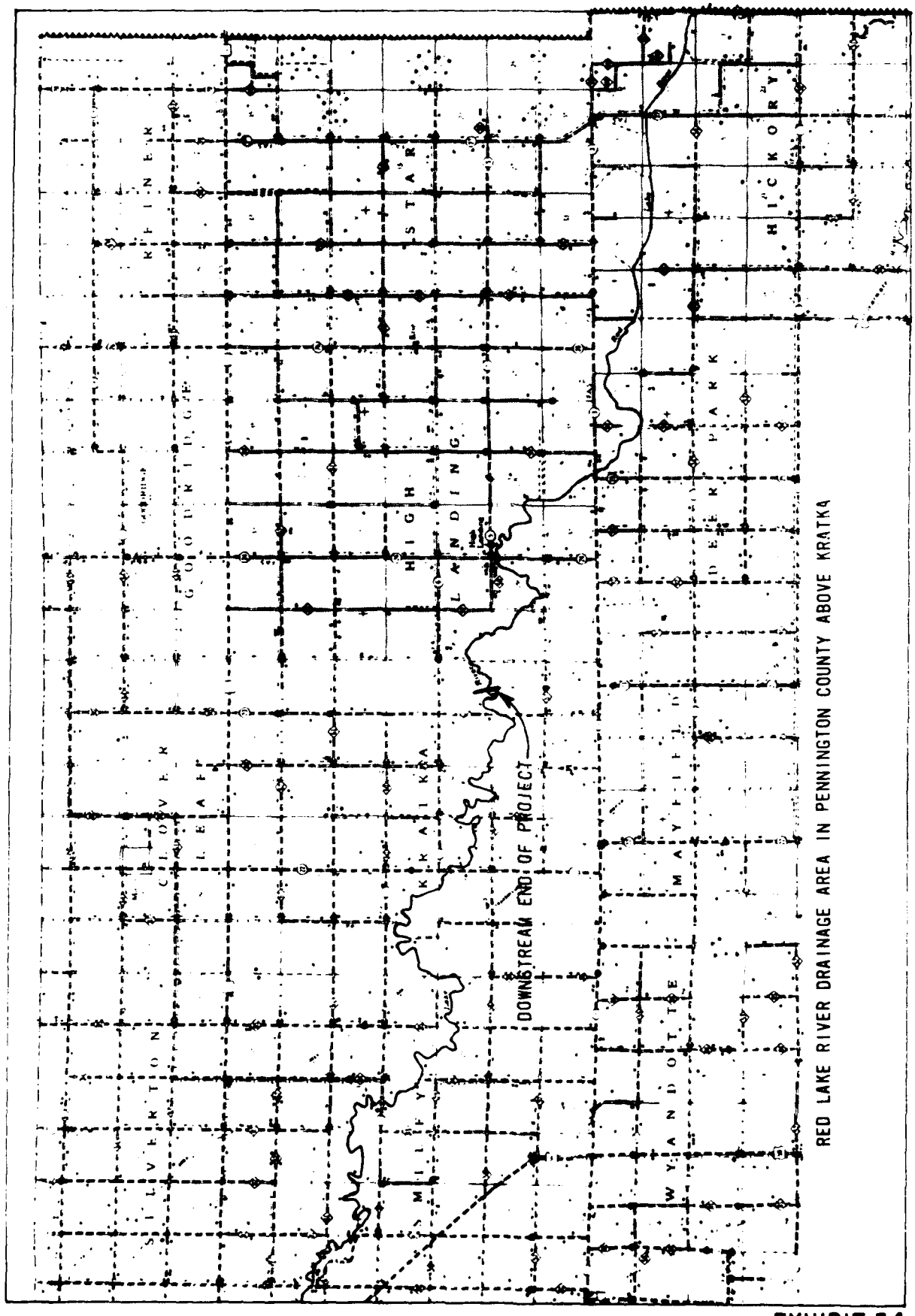

KRATKA
STAR
HICKORY
GOODRIDGE
HIGHLANDING
DEER PARK
CLOVER LEAF
SILVERTON
MAYFIELD
WYANDOTTE
DOWNSTREAM END OF PROJECT
RED LAKE RIVER DRAINAGE AREA IN PENNINGTON COUNTY ABOVE KRATKA

EXHIBIT 34

United States Department of the Interior

NATIONAL PARK SERVICE
MIDWEST REGION
1709 JACKSON STREET
OMAHA, NEBRASKA 68102

IN REPLY REFER TO:

L7619 MWR CE

OCT 17 1974

Mr. Max W. Noah
Colonel, Corps of Engineers
District Engineer
1210 U.S. Post Office
St. Paul, Minnesota 55101

Dear Colonel Noah:

We are pleased to respond to your letter of October 11 to Acting Regional Director Ryan requesting our comments concerning the existence of any historical, archeological and paleontological resources which might be affected by your planned operation and maintenance activities at the Red Lake and Clearwater Rivers Project, Minnesota.

We have reviewed the project information enclosed with your letter and determined that the proposed action will have no effect upon any existing or studied unit of the National Park System. Also, it will not affect any registered national landmark (natural or historic) or any site considered potentially eligible for national landmark (natural or historic) status.

Although records available to us do not indicate that any cultural resources are present in the area you have described, we cannot make the type of field reconnaissance needed to provide the assurance you seek that the actions proposed would have no impact on cultural resources. Appropriate agency procedures in this regard are described in the Code of Federal Regulations, Part 800.4, Procedures for the Protection of Historic and Cultural Properties.

We recommend that you consult with the State Historic Preservation Officer for Minnesota (Mr. Russell W. Fridley, Director, Minnesota Historical Society, 690 Cedar Street, St. Paul, Minnesota 55101) and with the State Archeologist (Dr. Elden Johnson, Department of Anthropology, University of Minnesota, Minneapolis, Minnesota 55455). They are

JOHNNY HORIZON '76

Let's Clean Up America For Our 200th Birthday

in the best position to give you recommendations regarding cultural resources within the project area. Responses received from them and any resulting action taken by you should be described in the draft environmental impact statement for the project.

Sincerely yours,

Merrill D. Beal

Merrill D. Beal
Acting Regional Director